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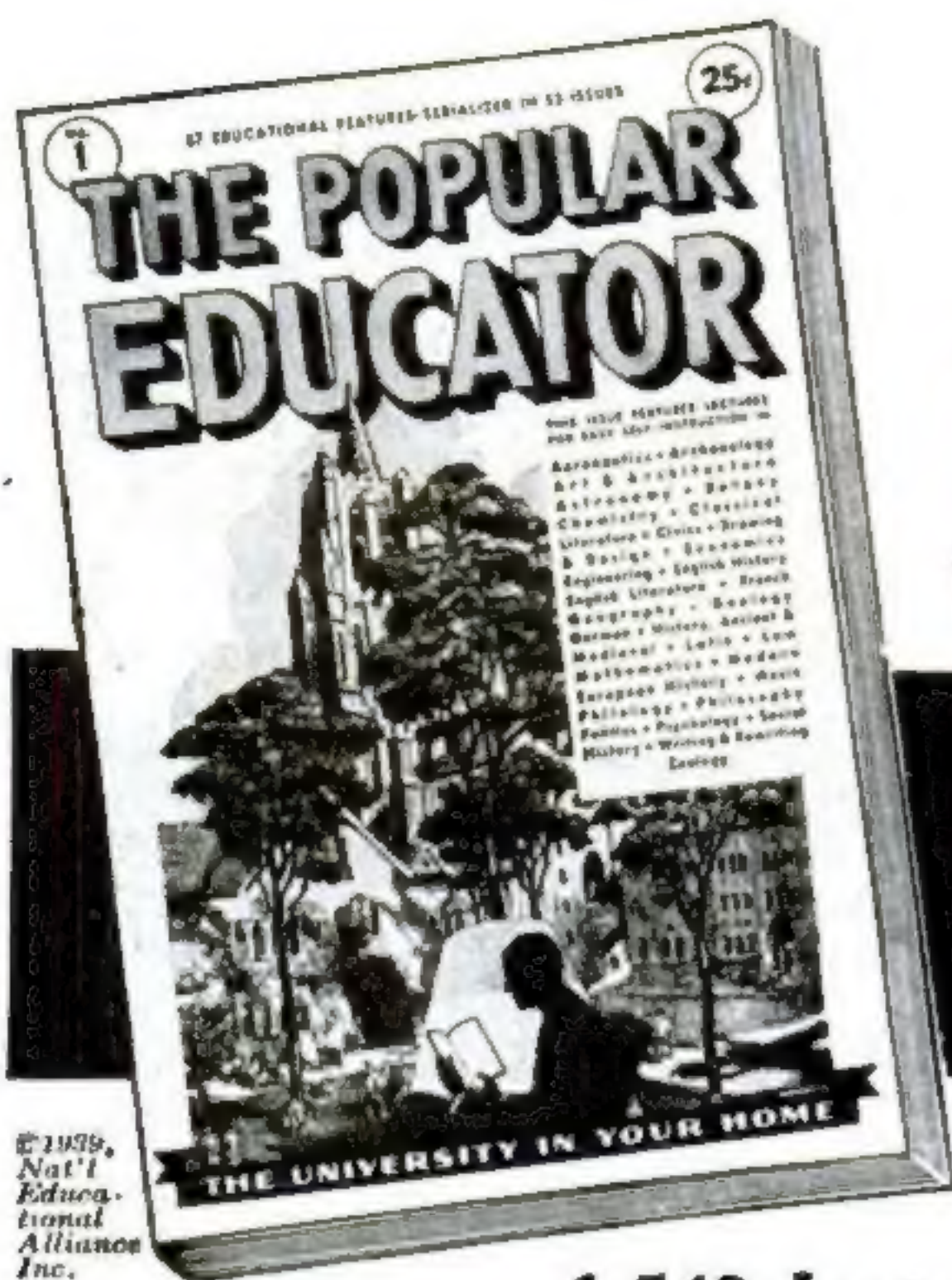
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Mechanics & Handicraft

Volume 135, No. 4

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MODERN HOME MEDICAL ADVISER

EDITED BY
MORRIS FISHBEIN, M.D.

Few of the Vitally Important Subjects Frankly and Thoroughly Covered

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In accidents, falls, bleeding, bruises, fireworks, wounds, burns, electric shocks, gas poisoning, fainting, bites, headaches.

Hygiene of Women
Disorders, exercises, Rhythm, the Safe Period, Conception.

Sex Hygiene
Anatomy and Physiology of reproductive system. Teaching of sex to the young child. Adolescence. The Honeymoon. Sex in middle and advanced life. Diseases of genital tract.

Care of Mother Before and After Childbirth

Care and Feeding of the Child

Infant Hygiene

Disease Prevention and Treatment

Infectious Diseases
Germs. Carriers of disease. Stamping out disease. Prevention of infection. Personal hygiene.

Infectious Diseases of Childhood
Diphtheria, measles, scarlet fever, whooping cough, chicken pox, mumps, infantile paralysis—how caused, how to identify, what can be done.

Respiratory Diseases
The common cold. How caused, prevention, treatment. Summer colds. Pneumonia. Tuberculosis.

Rheumatism, Arthritis, Gout

Diseases of Heart and Circulation

Digestion and Digestive Diseases

The Kidney: Its Diseases and Disturbances

The Blood and Its Diseases
What is a "Blood Count"? Wassermann and Kahn tests. Anemia. Blood transfusions.

Deficiency Diseases
Prevention and treatment of

Vitamin A deficiency.

Allergy and Hypersensitivity
Hay fever, asthma, hives, headache, eczema, etc. Various allergic agents; pollen, foods, animal hair, dust, smoke, insects, etc. Specific treatment.

The Internal Glandular System
Diabetes
Blood Pressure
Cancer

The Skin
Bathing: soaps, powders, creams, antiseptics, massage, sun baths. Inflammations of the skin: chapping, chafing, sunburn, rash, impetigo, corns, warts, body odor, wrinkles, acne, cancer of the skin. The hair and its care; graying hair; hair dyes; superfluous hair.

Eye, Ear, Tongue, Nose, Throat
Pink eye. Foreign bodies in the eye. Styes. Cataracts. Earache. Mastoids. Hard Wax. Infection of ear canal. Inflammation of tongue. Plastic Surgery of nose. Nosebleed. Sinus, and its treatment. Sore throat, tonsillitis.

The Venereal Diseases
Transmission of syphilis. Signs of syphilis, facts about it. Instructions for those with syphilis. May syphilitics marry?

Care of the Teeth

Advice on the Diet
Foods, fads, and fancies. Calories, vitamins, acid-base ratio in foods. Alcohol. Diets. Food poisoning.

Posture

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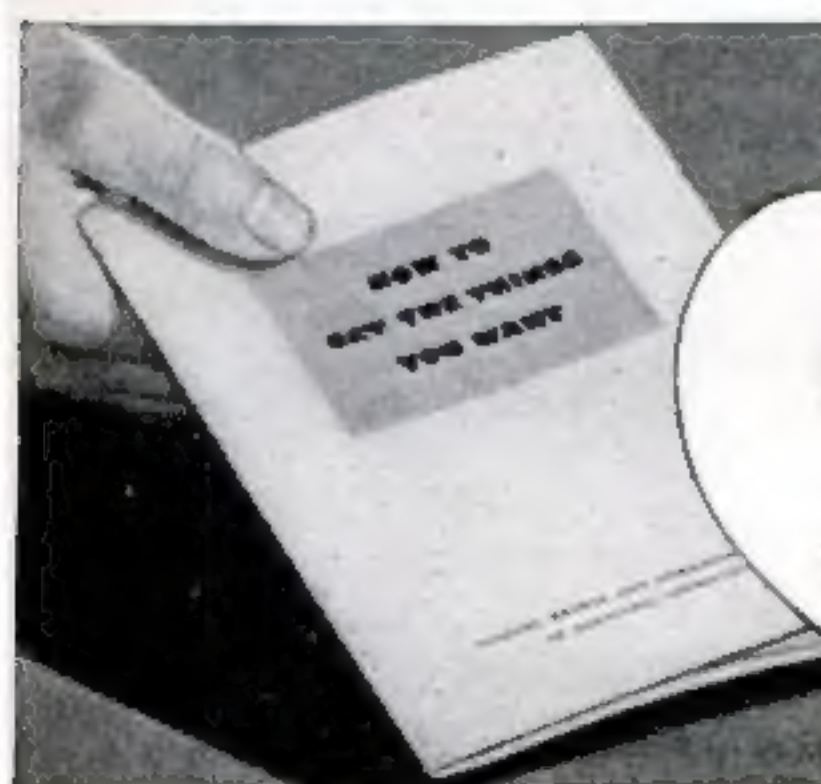
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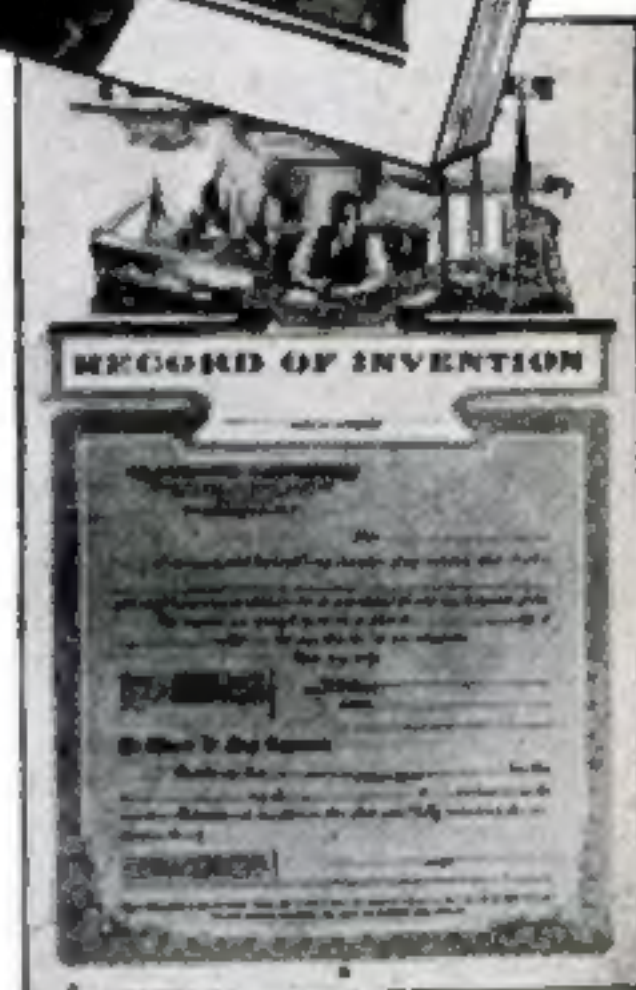
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| <input type="checkbox"/> Architectural Drafting | <input type="checkbox"/> Contracting and Building | <input type="checkbox"/> Mechanical Drafting | <input type="checkbox"/> Mechanical Engineering | <input type="checkbox"/> Steam Electric Engineering |
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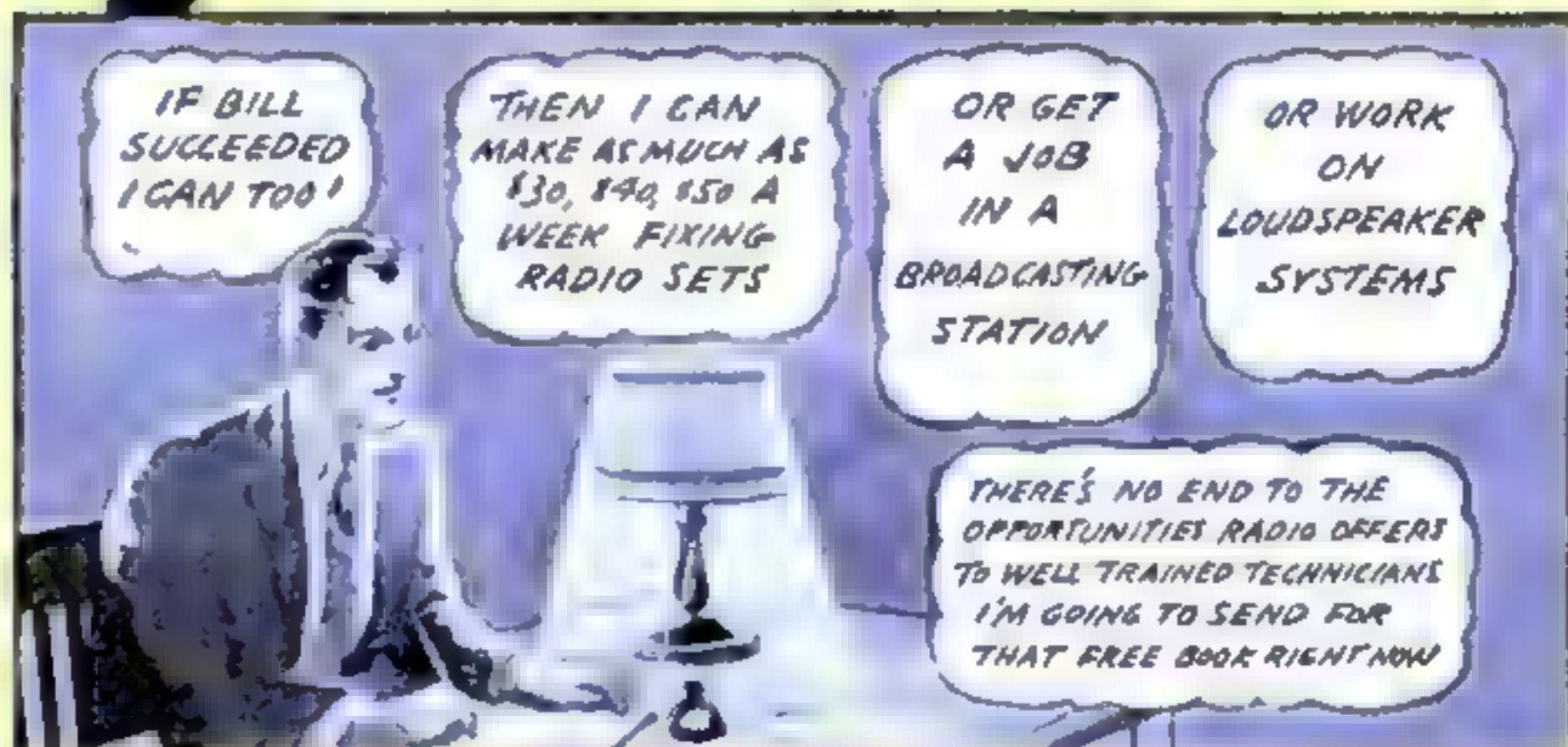
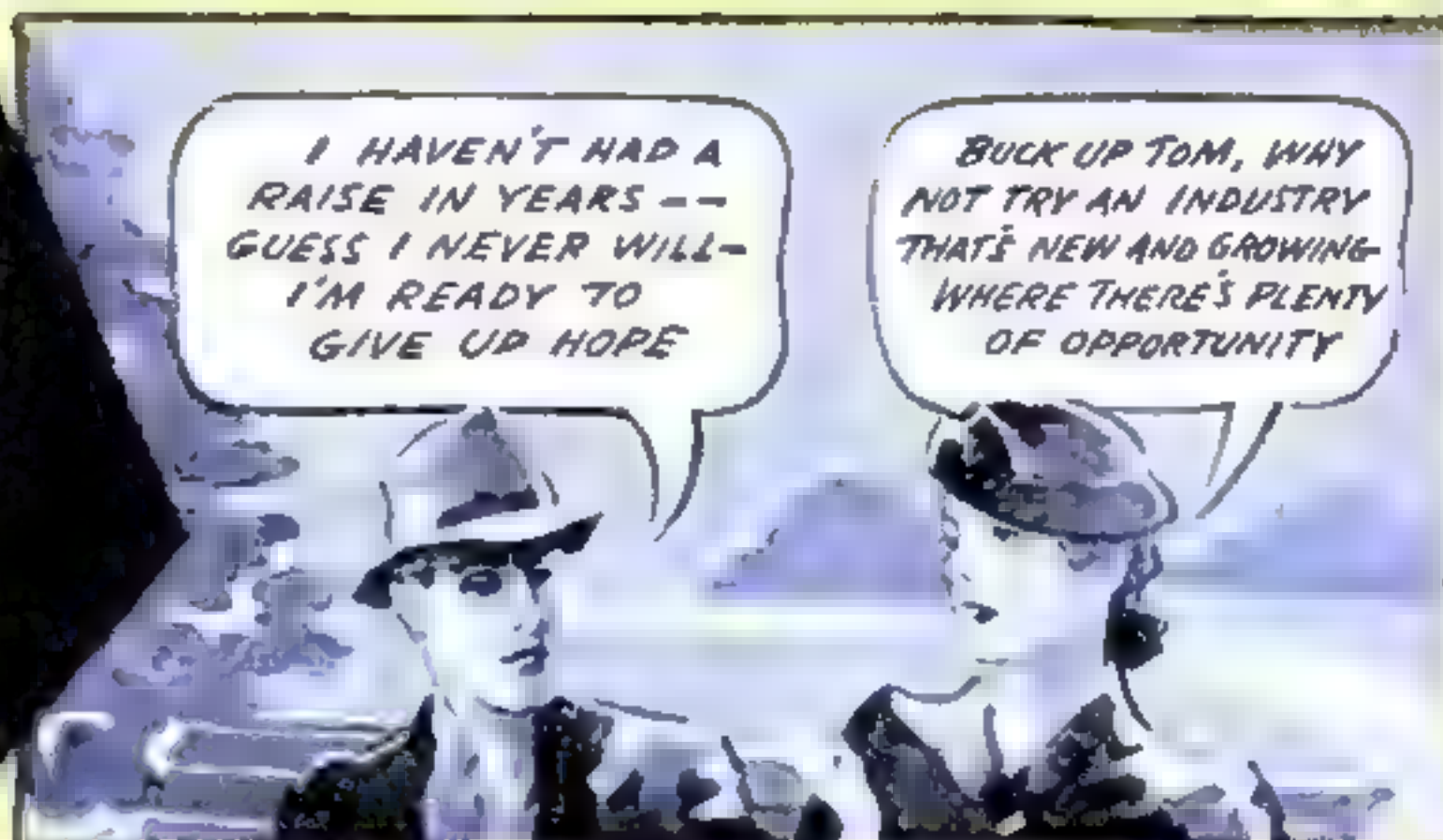
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HOW A "TIP" GOT TOM A GOOD JOB



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Radio is a young growing field with a future. It offers many good pay spare time and full time job opportunities. And you don't have to give up your present job, go away from home, or spend a lot of money to become a Radio Technician. I train you right at home in your spare time.

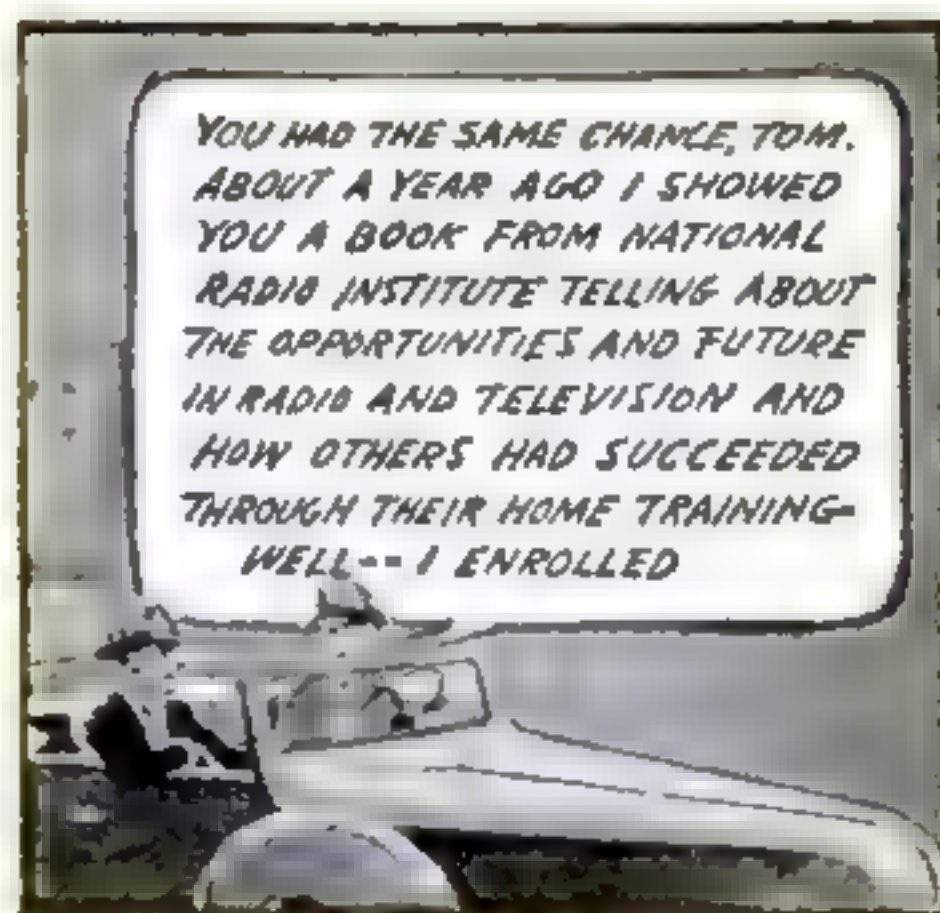
Jobs Like These go to Men Who Know Radio

Radio broadcasting stations employ engineers, operators, station managers and pay well for trained men. Radio manufacturers employ testers, inspectors, foremen, servicemen in good-pay jobs with opportunities for advancement. Radio jobbers and dealers employ installation and servicemen. Many Radio Technicians open their own Radio sales and repair businesses and make \$30, \$40, \$50 a week. Others hold their regular jobs and make \$5 to \$10 a week fixing Radios in spare time. Automobile, police, aviation, commercial Radio; loud-speaker systems, electronic devices, are newer fields offering good opportunities to qualified men. And my Course includes Television, which promises to open many good jobs soon.

Why Many Radio Technicians Make \$30, \$40, \$50 a Week

Radio is already one of the country's large industries even though it is still young and growing. The arrival of Television, the use of Radio principles in industry, are but a few of many recent Radio developments. More than 28,000,000 homes have one or more Radios.

Get Facts About THIS



There are more Radios than telephones. Every year millions of Radios get out of date and are replaced. Millions more need new tubes, repairs, etc. Over 5,000,000 auto Radios are in use and thousands more are being sold every day. In every branch Radio is offering more opportunities—opportunities for which I give you the required knowledge of Radio at home in your spare time. Yes, the few hundred \$20, \$40, \$50 a week jobs of 20 years ago have grown to thousands.

Many Make \$5, \$10 a Week Extra

In Spare Time While Learning

The day you enroll, I start sending you Extra Money Job Sheets which start showing you how to do Radio repair jobs. Throughout your Course I send plans and directions which have helped many make \$200 to \$500 a year in spare time while learning. I send special Radio equipment to conduct experiments and build circuits. This 50-50 training method makes learning at home interesting, fascinating, practical.

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Act today. Mail coupon for my 64-page book, "Rich Rewards in Radio." It points out Radio's spare time and full time opportunities and those coming in Television; tells about my course in Radio and Television; shows many letters from men I trained, telling what they are doing and earning. Read my money back agreement. Find out what Radio offers you. Mail coupon in envelope or paste on penny postcard—NOW.

J. E. SMITH, President, Dept. 9KP3,
National Radio Institute, Washington, D. C.



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Here is the type of instrument successful Radio Technicians use—an All-Wave Set Servicing Instrument. It contains everything necessary to measure A.C. and D.C. voltages and current; to check resistances; adjust and align any set, old or new. It satisfies your needs for professional servicing after you graduate—can help you make extra money fixing sets while training.

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Dear Mr. Smith: Send me FREE, without obligation, your 64-page book "Rich Rewards in Radio" which points out spare time and full time opportunities in Radio, those coming in Television, and explains your 50-50 method of training men at home in spare time to be Radio Technicians. (Write Plainly.)

NAME..... AGE.....

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THIS
Free Book
HAS HELPED
HUNDREDS OF MEN
MAKE MORE
MONEY



TESTED WAY TO BETTER PAY

Our Readers Say



The Combination Is Too Much for This Fellow's Nerves

IT CAME to my attention recently that the \$16,000,000,000 in gold kept in Uncle Sam's repository at Fort Knox, Ky., is protected by—among other things—a lock, the combination to which is intrusted to two men. Yet, neither of the men could open the lock by himself, for

GOT TO GET CAR FARE SOMEHOW!



each knows only half of the combination by which the thirty-six-ton door is opened. I'm not exactly losing sleep over it, but I would certainly like to know how this most up-to-date of fool-proof, burglarproof, and everything-elseproof vaults would be opened if anything happened to one of the keepers. The problem gets exactly twice as complicated

when I try to think of the consequences if something should happen to both of them. To tell the truth, I *am* losing some sleep over it, especially when I realize what a time I have "cracking" my own penny bank to get busfare so I can get to work. If Uncle Sam is going to keep his pin money salted away in a place like that, he ought to be able to get at it without depending on the health and memory of two men!—T.H.M., Cleveland, Ohio.

It Got Down in the Works and Got the Works!

HAVING read about those superstretched rat tails (tales), I think I have one that tops the lot. My kid sister was listening to a radio swing band when all of a sudden there issued from the loudspeaker a puff, a bang, and sundry other strange sounds, followed by complete silence. I should have pointed out that

WHAT A WAY TO DIE, CUTTIN' A RUG, YEAM MAN!



the swing band stopped first. The aroma of a roadside lunch stand drifted about the now quiet room. Upon taking the chassis out of the cabinet, I came upon—guess what—an electrocuted rat, not to mention a burned-out resistor and the makings of a nice repair-job bill. The double-crossing creature had got down in the base through an

opening near a tube, and got the works! As it turned out, it was not a cheap solution to the rat problem.—R.McG., Bridgeport, Conn.

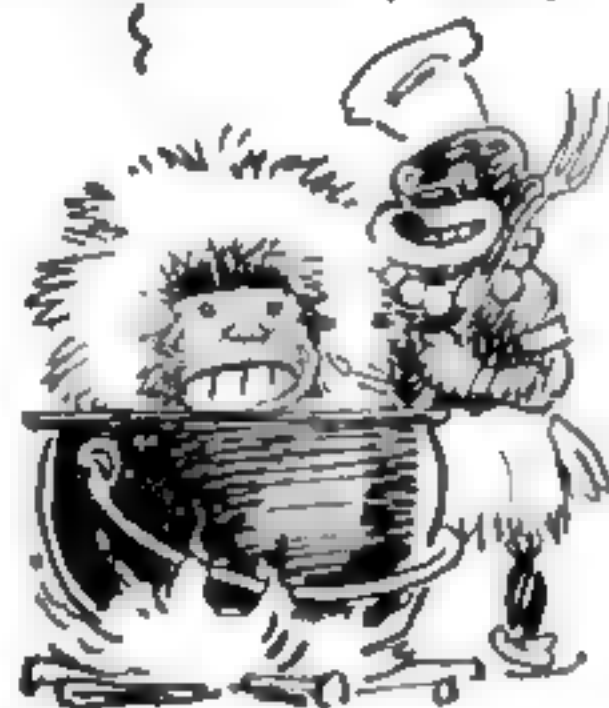
"Oxygen, Oxygen Everywhere And Not a Drop To Breathe"

THE tragic sinking of three submarines within a month of one another, not long ago, has set me thinking. I wonder why they do not produce oxygen below the surface of the ocean by electrolysis of water. The salt water of the ocean can be very simply purified, acid can be added as a conductor, and an electric current passed through. The hydrogen might be conserved for buoyancy use, or let off, and the oxygen conserved for breathing. If any reader sees any loophole in my idea, I wish he or she would answer this letter.—J.R., Montreal, Canada.

And the Chances Are Pretty Good He'd Sweat Off More Than That

I.T., of Rye, N. Y., asks, "Since the centrifugal force is greatest at the equator and zero at the poles . . . why wouldn't I weigh less at the equator?" Here's my answer to his question: The strength of the centrifugal force at the equator amounts to about five ounces in a cubic foot of water, which weighs almost exactly 1,000 ounces. In other words, a nice, fat, roly-poly Eskimo weighing 200 pounds would lose about one pound if he journeyed from the north pole to the equator.—A.H., Portland, Ore.

JUST ONE POUND, HUH?



It's a Lot To Hope For, but—Here's Hoping Anyhow

DURING a good part of the summer, there was a serious drought over a large area of eastern New York, most of New Jersey, and some neighboring states, and the native farmers, suburbanites, and gardens were alike burned up. Now don't get bored: I'm not writing about the weather. What I'm seeking is some entomological (bugs to you) information. I've noticed that mixed with the hardship, there has been at least one blessing; namely, during the drought there was hardly a mosquito worthy of the swat! On the other hand, there were Japanese beetles aplenty. Visibly fewer were the lightning bugs, and audibly fewer the usually abundant crickets, tree toads, and other creatures that (Continued on page 14)

He Climbed—Out of a Mine Shaft Into a Chief Executive's Chair!

THE AMAZING STORY OF A LASALLE STUDENT*



Back in 1921 I was a laborer with nothing ahead of me, apparently, but the hard life of a laborer. Then I enrolled for LaSalle training in Accountancy. It wasn't easy to study, but discouraged, yet vaguely hopeful, I plugged away.



A year later I went to work in a copper mine, 3800 feet underground, still keeping up my study. If conditions were bad before—they were worse now! But something drove me on, and the encouraging letters from my instructors kept the light of hope burning.



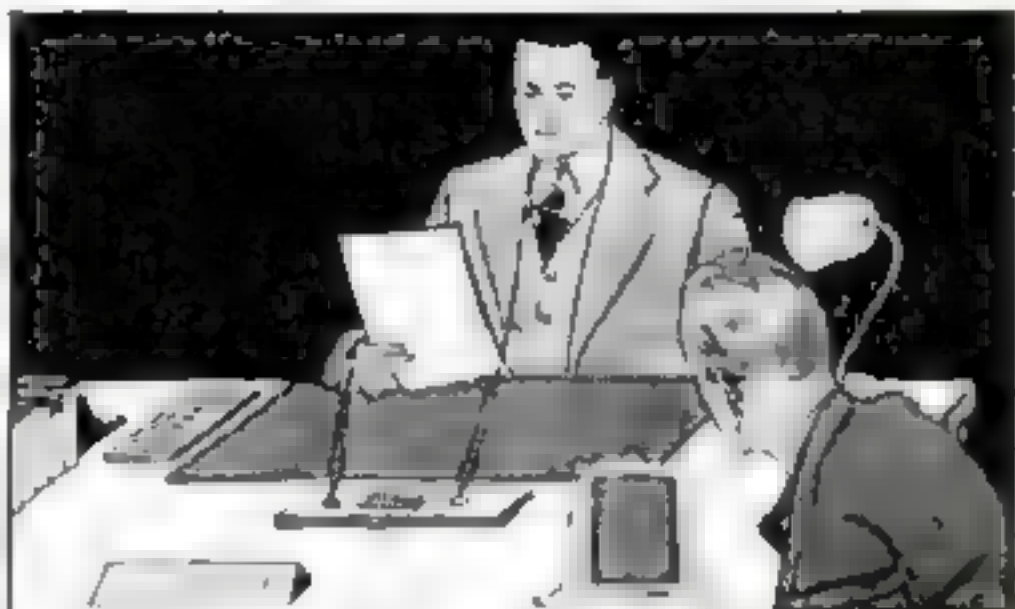
When I was only half-way through I decided to go to Los Angeles and try to get a job. I had had no experience other than my training, which I found actual—not theoretical. Presenting my evidence of study and character, I was employed as assistant bookkeeper.



Within the next two years I made rapid progress, and was promoted to the position of office manager, with consequent increases in salary. By this time I had completed my course—the foundation for my complete accountancy knowledge being this splendid LaSalle training.



I decided I would go further. I would be a Certified Public Accountant. I joined an accountancy firm and took the LaSalle C. P. A. coaching course. Last May I took the State examination. I passed, I was finally a Certified Public Accountant! My goal had been reached!



I shall never be able to express my gratitude for the opportunity to fight my way from a laborer's job to a C. P. A.'s desk. To any man of intelligence who wants to get out of the rut and succeed, I recommend that he enroll with LaSalle.

Spare-Time Training Promises Great Rewards Today

THIS true story illustrates what a man can do, who is resolved to get out of a rut and is willing to invest his spare time now for the sake of tremendous dividends later.

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- ☐ Salesmanship
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Name _____ Position _____

Address _____

Our Readers Say (CONTINUED)

make any fine summer night a finer one. What I want to know is this: Will the effect of the drought on these mixed blessings of summer be permanent? Can we hope for fewer Japanese beetles and perhaps no mosquitoes at all next year, without permanent loss of the less troublesome insects too? If that were the case, we Jersey residents, at least, could forgive the temporary damage. Here's hoping! —K.S.P., Glen Ridge, N. J.

High Standards (and No High Kicking) Are What He Wants in Drum Majors

NOT once in three or four years have I objected to any article you've printed, but the one about the girl drum majors got my dander up. Drum majoring is, or I should say was once, a position to be held only by the most capable military and musical leader—the commanding officer and drill master of his band, taking orders from no one. Either the public no longer appreciates seeing and hearing a good band or drum corps, or these have become so lousy that in

G'WAN, A HE-MAN LIKES THE GALS!



order to attract attention they must lower themselves to marching behind a beautiful, high-kicking, scantily dressed, dancing, writhing chorus girl who is neither capable of directing a band or meeting the fine military and musical requirements once demanded of a drum major. In my opinion, a

real he-man's magazine such as yours should do its utmost to keep American bands and drum corps to the high military and musical standards of past days. This can only be done by discouraging the foul evils of feminine drum majoring. You should be ashamed of yourselves for such an illogical damned article.—J.T.C., East Orange, N. J.

Old Man Earth Hitched His Belt a Little Bit Too Tight

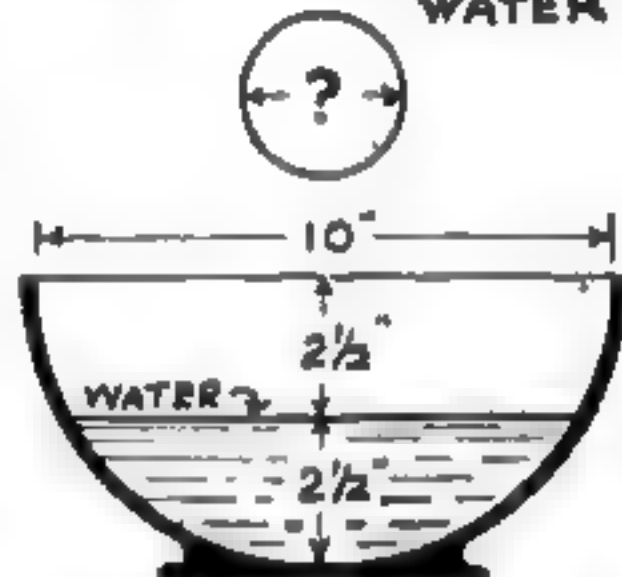
THIS reader heartily agrees with N.L., of Alberta, Canada, in saying that the "Drayson theory" of the ice ages cannot explain the frozen mammoth found in the arctic wastes. However, his own magnetic-attraction theory seems wrong because neither pole of the earth points at the sun at present. Why not use the theory that the earth once had belts around it like those of Jupiter and Uranus, and rings like those of Saturn. These belts, composed mostly of snow and ice, fell with cataclysmic force in recent geologic times, trapping the mammoths. The last great fall was within historic time, and caused the great Flood of Noah's time. I believe that I have proved the

plausibility of this theory mathematically, and can explain with it such things as the ice ages, the Flood, and the frozen mammoths.—L.S., Altadena, Calif.

Reader Submits a Tough One Just To Even Things Up

AFTER that trick but easy problem about the chiseling bell-hop, which I told to a lot of my friends who were just as dumb as I was when I first read it in your magazine, your readers ought to be able to take one that's a little bit on the tough side. Here it is: A hemispherical bowl with an inner diameter of exactly ten inches is exactly half full of water; that is, the surface of the water is two and a half inches below the top of the bowl. What is the diameter of a ball which, placed in the bowl, is just covered by the water?—W.W., Cleveland, Ohio.

BALL WHEN SUBMERGED JUST COVERED BY WATER



And After All, They're the Ones Who Really Ought To Know

REPLYING to R.L.P., of Bellevue, Pa., I find that the most satisfactory correction fluid for use with stencils is that made by the makers of the stencils. If the directions are carefully followed, it is possible to make corrections that will fool an expert. The fellows making the stencils know their stuff, and their products cannot be beaten by any makeshift fluids.—A.H.B., Los Angeles, Calif.

Whistles on Oil-Well Engines Give Birds Some Competition

THE article on "Pumping Oil by Remote Control," reminded me of a clever stunt I saw in the oil fields of eastern Kentucky. Out there, they have separate engines pumping oil from the different wells, and one man will be assigned to look after several wells scattered over a considerable stretch of country. He puts a whistle on the exhaust of each engine, tuning the whistles to different pitches. Then he can loaf in his shanty or hunt squirrels over the hills, and if one of his engines stops running, he notices it at once and knows which pump needs attention. He gets so accustomed to the pip—*(Continued on page 16)*

IF I HAD THE ENERGY I'D GO FOR A JOB LIKE THAT!



You Ask Me What I Am Doing?



I Am Getting Ready to Earn More Money ... Preparing for a Bigger Job

I am a student of the American School, Chicago. A little more than half way through my course—already my increased knowledge has brought me promotion as a result of the hour or so a day I have been spending getting acquainted with the principles of the work I enjoy. I use only part of my spare time, so it doesn't interfere with my home and social life, and certainly helps me on the job.

I have been surprised at the practical manner in which even advanced work is explained. It is a lot easier than I had expected. I only wish I had started this plan of getting ahead a few years earlier. But when I was 18 to 20 I felt pretty sure of myself. I didn't take enough stock in what more experienced people told me about the importance of being thoroughly trained for the job I wanted.

You Can't Win If You Don't Try

American School, Dept. G-746, Drexel Ave. at 58th St., Chicago

CUT ALONG THIS LINE

Try a Lesson Yourself—No Obligation

American School, Dept. G-746, Drexel Ave. at 58th St., Chicago

I have checked the line of work in which I would like a good job. Please send me without expense or obligation on my part a copy of your Bulletin and an early lesson in the field I have selected.

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- ☐ Architecture
- ☐ Automotive Engineering
- ☐ Automobile Repairing
- ☐ Bookkeeping and Cost Accounting
- ☐ Business Management
- ☐ Civil Engineering
- ☐ Aviation
- ☐ Contracting, Building

- ☐ Electrical Engineering
- ☐ Diesel Engineering
- ☐ Drafting and Designing
- ☐ Electric Refrigeration
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- ☐ Highway Engineering

- ☐ Law
- ☐ Liberal Arts (College)
- ☐ Mechanical Engineering
- ☐ Merchandising
- ☐ Private Secretary
- ☐ Radio and Television
- ☐ Salesmanship
- ☐ Shop Practice
- ☐ Steam Engineering



Name _____ Age _____ Occupation _____

Street _____ City _____ State _____

Our Readers Say (CONTINUED)

ing of the different whistles that he never notices them until one stops—but that will wake him up, even if he is fast asleep. It makes a strange impression on anyone who visits the oil fields for the first time, to hear those "peep-peeps" echoing across the hills, like the calls of some huge prehistoric birds.—J.G., Louisville, Ky.

Rule No. 1 for Photographers: Keep Fingers Away from the Lens

AS A long-time reader of POPULAR SCIENCE, I think I'm eligible to say it's a fine magazine with all the dope for us guys interested in chemistry, photography, entertaining feature

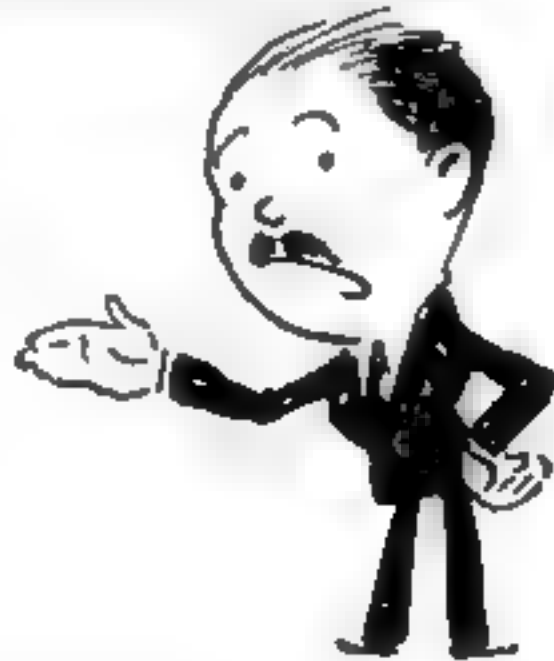
articles, and so on. I think it's a good idea to equip our minions of the law with cameras, as you describe, but it would be a good idea to teach them to keep their fingers out from in front of the lens, as the first cop in the picture is *not* doing. Many of us do this, but it wouldn't help a court case any to have a pic' half blotted out when the blotted part

might cinch a case, one way or the other.—W.M.B., Sioux City, Iowa.

We'll Bet the Greeks Had a Shorter Word for It

ANY good dictionary plus a little effort would help S.A.S. get at the meaning of his quotation from Einstein. Big words are sometimes as useful to science as Greek was to Homer. You can translate it, but you must read it in the Greek to hear the music. Einstein's "The empirical quantum of the gravitational equation bridges the corpuscles of the material eschatology by subliminal energy evolved counterclockwise out of analogous infinities," by substitution of synonyms, reads as follows: "Based on experiments, the energy released by one step of atomic activity, of the gravitational equation, bridges the particles of the doctrine of material destruction, by awakened energy unfolded counterclockwise out of similar space at the ends of the universe." Further simplified, it reads: "Everything will in time fall into the center of the universe, and be changed to heat by collision. The heat will radiate into space, condense, revolve, and come back again as new celestial bodies."

WHY NOT JUST SAY
ROUND 'N' ROUND!



Incidentally, I like your magazine so much that I read it from both ends. I read it twice.—W.A.D., Elysburg, Pa.

City Pride Speaks Up— New Yorkers Please Note

ONE might get the idea from your article about the transatlantic airplane service that the planes fly *only* from New York City. The fact of the matter is that Pan-American's main base is at Baltimore, that the ships are registered there, that they are based there, and that all the transatlantic flights start from there. Once a little bad weather sets in, New York won't see the clippers again until next spring.—V.E.S., Baltimore, Md.

H'RAY FOAM
BALTIMOAH!



But Suppose the Trainmen Forgot Where They Were?

WHY don't the railroads hide their signal cords so dumb passengers can't get at them? I recently saw a train stopped for five minutes on a busy main line, just because some self-important cuss thought he could stop a through flyer at any crossroads, like a bus. Trainmen had to go through the whole train to find the trouble.—E.M., Trenton, N. J.

A Reader Sheds Some Light on Synchronizing Flash Guns

PLEASE tell S.G., of Laredo, Tex., that the following method of synchronizing his camera's flash gun should fix him up. He can get an adapter plug to put in his flash-gun socket at any photo shop. This will permit screwing in a bulb of proper voltage from an ordinary flash light. Or he can run temporary wires from his socket to the bulb. In either case, center the bulb in front of the camera lens. Remove the back of the camera. Set the shutter speed at a fiftieth of a second, which is sufficient for average needs. Watching through the back of the camera, trip the shutter over and over again, backing off the adjusting screw until the shutter snaps before the light is lit. Still snapping the mechanism, turn the screw back slowly until the light appears. Then tighten the lock nut, and you are all set.—K.D.F., Canton, Ohio.

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FLASH BULB!



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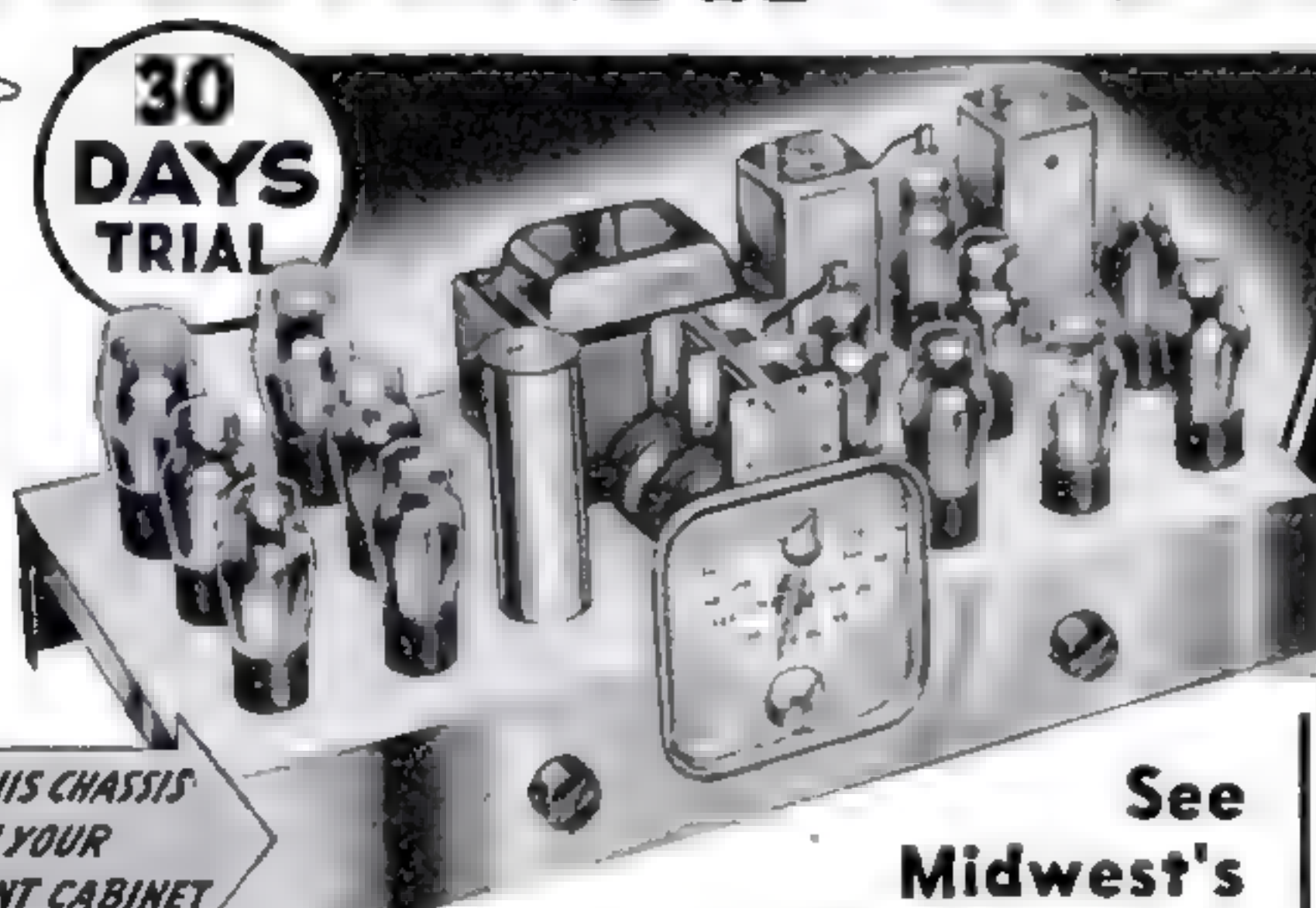
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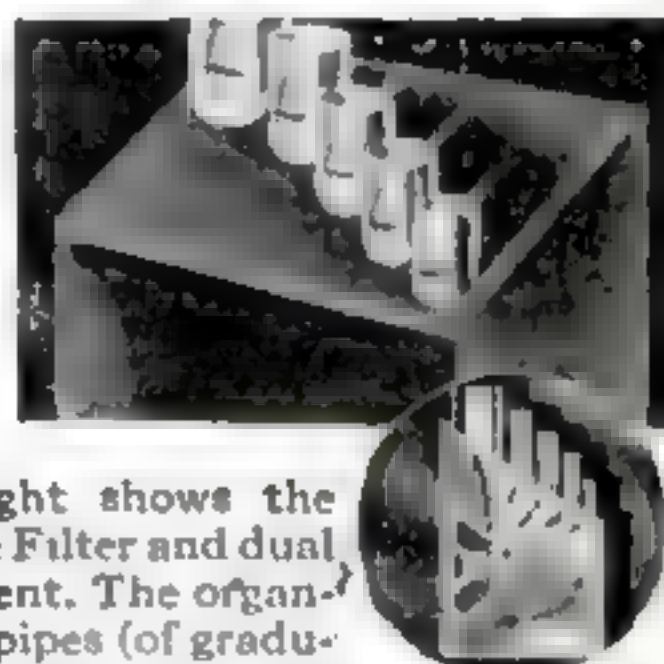
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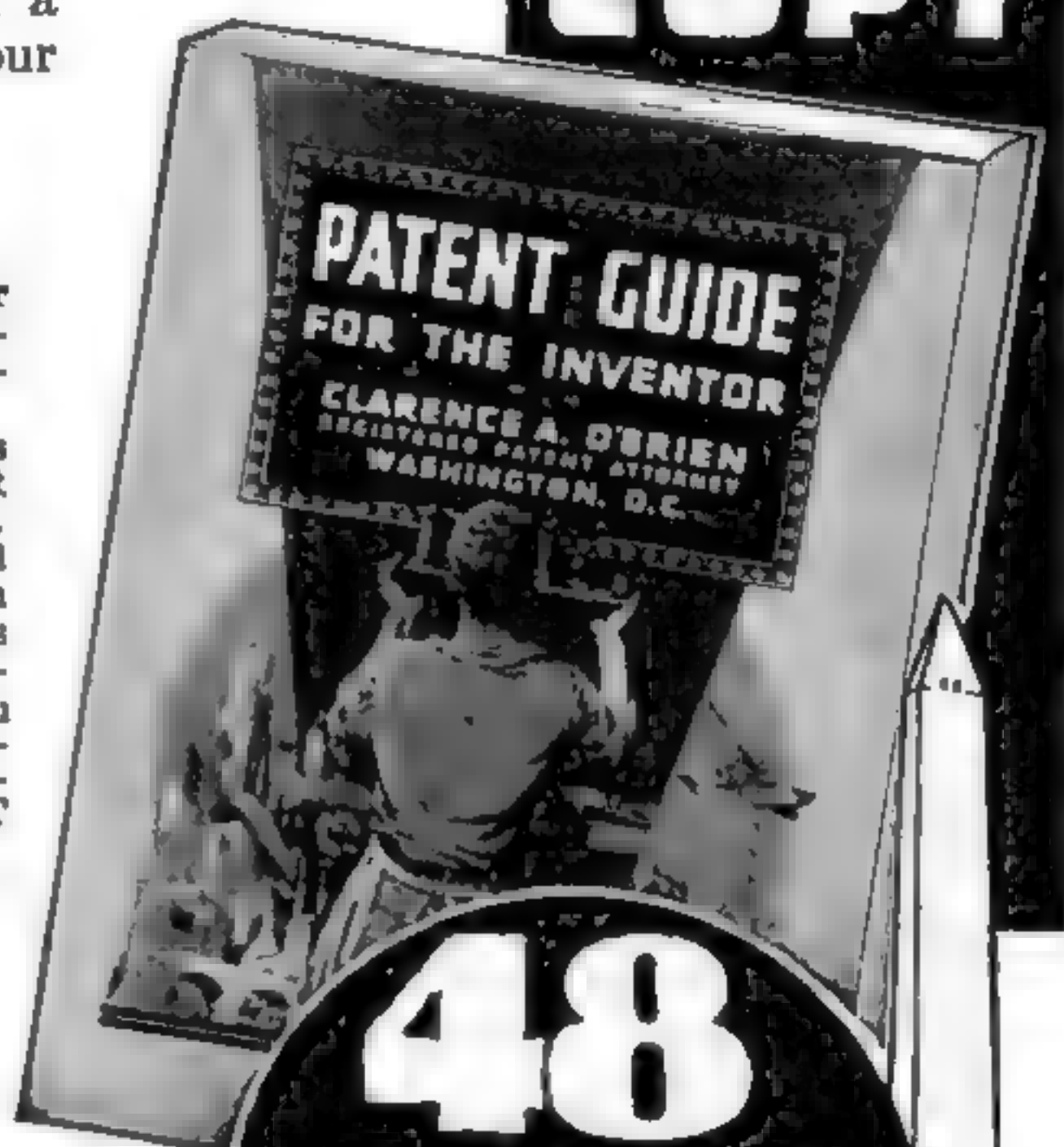
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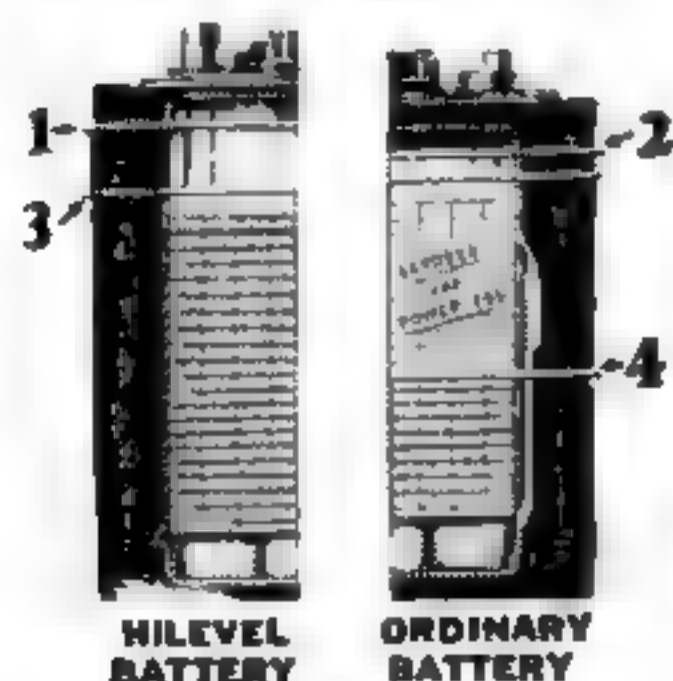


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- 2** FILLING LEVEL of ordinary battery.
- 3** By the time the fluid in a HiLevel Battery drops to here, (note plates are still covered) . . .
- 4** . . . in an ordinary battery it falls to here, leaving a large part of the plate surface exposed and powerless.



Handy Can for Dry Glue Has Legs for Heating

DRY GLUE is now being marketed in containers fitted with wire legs and bails to make it easy to prepare the adhesive for use. When the lid is removed from the can, about half of the contents is poured out and saved for future use. The remainder is covered with water, and the container set on its legs in a pan of hot water until the glue melts. After use, the glue is allowed to cool, and remelted later as required.

Questions FROM HOME OWNERS

Q.—I AM building an ice box for a trailer. What kind of finish can I put inside the inner cabinet of the wooden box that will not cause foods to absorb the odor?—A.N.R., Coquille, Ore.

A.—A VERY high-grade enamel, we have found, is satisfactory for the interiors of ice boxes, since it will leave no odor once it has become thoroughly dry and hard. It must be applied at a temperature above seventy degrees F., and allowed to dry for several days, with the ice-box door left open. Any high-grade enamel of the type known as "automobile" or "bath-tub" enamel should serve your purpose.

Red-Maple Oil Stain for White Pine

J.K.K., HACKENSACK, N.J.—If you prefer to mix your own oil stain for giving white pine a red-maple effect, obtain from a paint store a quantity of dry, powdered umber, part in a bright-red and part in a bright-yellow color. Mix these with about one part

(Continued on page 26)

Why Trained Accountants Command

—and how ambitious men are qualifying
by the LaSalle Problem Method

High Salaries

GET this straight.

By "accountancy" we do not mean "bookkeeping." For accountancy begins where bookkeeping leaves off.

The skilled accountant takes the figures handed him by the bookkeeper, and *analyzes* and *interprets* them.

He knows how much the costs in the various departments should amount to, how they may be lowered.

He knows what profits should be expected from a given enterprise, how they may be increased.

He knows, in a given business, what per cent of one's working capital can safely be tied up in merchandise on hand, what per cent is safe and adequate for sales promotion. And these, by the way, are but two of *scores* of percentage-figures where-with he points the way to successful operation.

He knows the intricacies of government taxation.

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Present Position.....

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Questions from Home Owners

(Continued from page 24)

of boiled linseed oil and two parts of turpentine, adding umber in either shade until you have the tone of red-maple stain desired. It is a good idea to test out a small sample of the stain on a piece of scrap wood before mixing the whole amount.

Peeling Wall Paper

R.T.O., SCHENECTADY, N.Y.—Either poor-quality paste or the lack of size in the wall could cause the peeling of even recently applied wall paper. To remedy the condition, if the paper is not torn or cracked, puncture the paper at the top of each loose section, insert the tube of a small ear syringe filled with paste, and inject as much of the paste as is necessary. Then press the loosened paper back in place with a piece of clean cloth.

Repainting Radiators

Q.—OUR radiators are covered with a coat of aluminum paint. Will it be necessary to remove this if the radiators are to be painted another color? Will the undercoat of aluminum interfere with efficient heat radiation? —J.C.P., Ipswich, Mass.

A.—AN UNDERCOAT of aluminum, followed by flat wall paint, will not retard the radiation of heat. If you are repainting the radiators, we suggest that you sandpaper or rub down with steel wool the aluminum coating to make it perfectly even before applying the flat wall paint.

Cracks in Enamel Washbasin

Q.—THE white enamel washbasin in our bathroom has a shallow but unsightly crack that shows a rust-colored line. How can the line be removed, and what cement can be used for filling the crack? —S.Z., Oakland, Calif.

A.—RUB the crack line with a scratchless cleansing powder moistened with kerosene. For filling the crack, you might try a new patching cement that completely fills cracks in porcelain by expanding as it sets.

How To Soften Putty

A.V., NEW YORK CITY.—When removing glass panes from windows, the putty can be made soft and easy to cut out by painting over it with a brush dipped in a solution of caustic soda. After about an hour, the putty will be softened.

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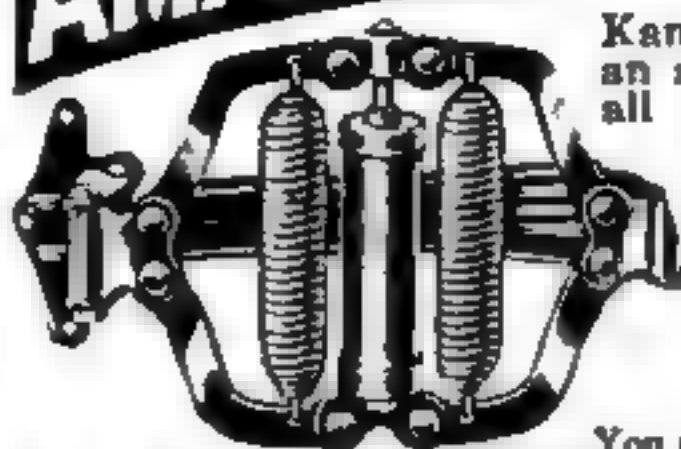
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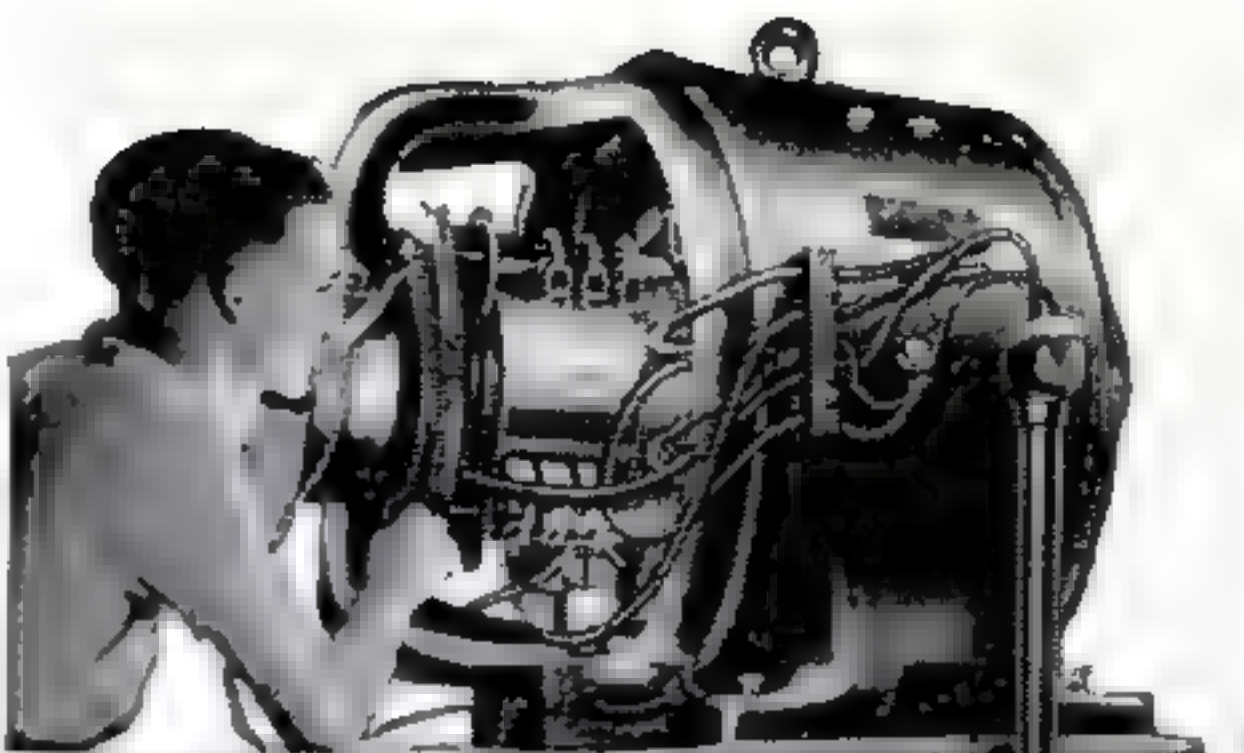
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With the Inventors

AN ELECTRIC-SWITCH TOGGLE becomes the nose of a gnome or ogre in a clever and amusing calendar for children, which recently won a design patent for Harry M. Kidd, of El Paso, Tex. The calendar bears a portrait of a legendary character, complete except for a rectangular hole where the nose



should be. When the calendar is placed on a wall over an electric switch, the toggle juts through the hole to form the portrait's nose, which is "tweaked" to turn lights on or off . . . TO CORRECT THE ABUSE of having patents kept pending for long periods of time by inventors or their attorneys, Conway P. Coe, U. S. Commissioner of Patents, has suggested a change in regulations whereby a patent would normally extend for the present seventeen-year period, but would automatically expire twenty years after the date when the application for it was first filed—regardless of when the patent was actually granted . . .



HIKERS, CAMPERS, AND OTHER outdoor-sports enthusiasts may welcome a novel garment designed by a Seattle, Wash., inventor, Ome C. Daiber, which combines a warm jacket and a knapsack. Built into the back of a regulation outdoor jacket, the pack has an opening along one side through which articles may be inserted or removed. Straps on the inside of the jacket fit over the shoulders of the

wearer to help support the weight of the built-in pack when it is full . . . PATENT 2,165,690, issued to Warrington C. Wademan, of West Orange, N. J., for a navigation instrument, has only one claim. What makes this note-

(Continued on page 32)

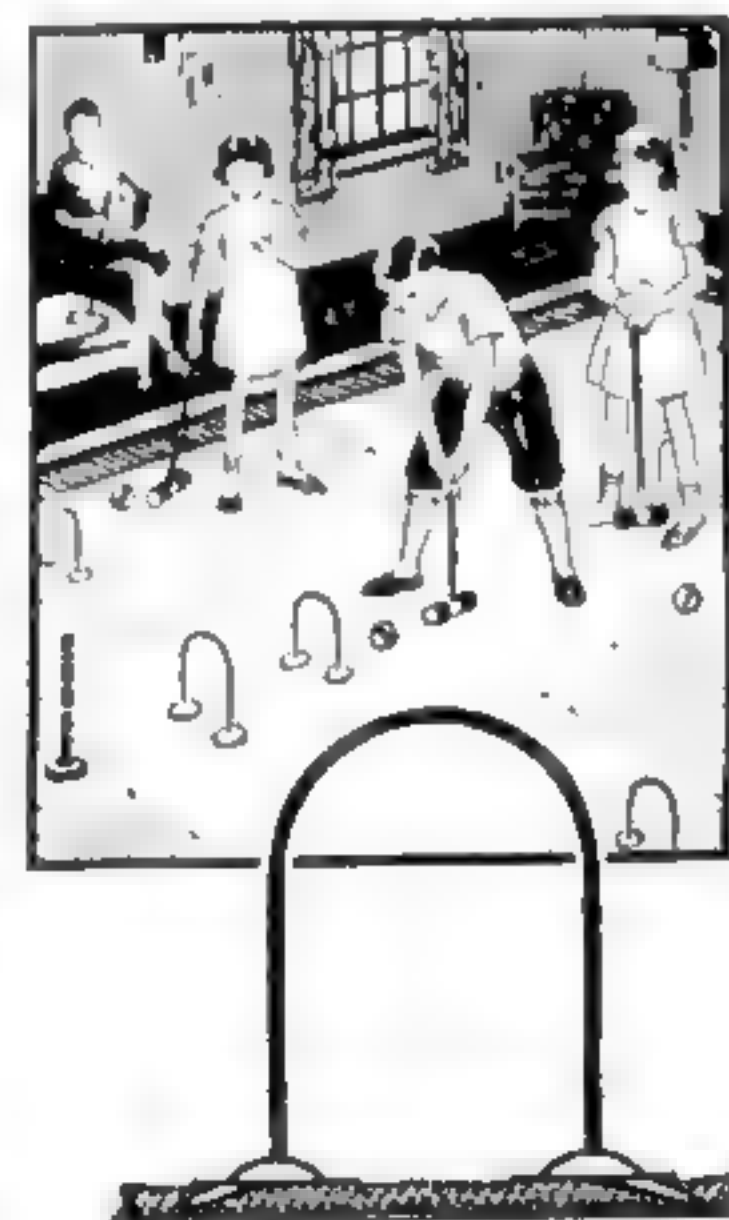
worthy is the fact that the claim, stated as all claims are in a single sentence, runs to more than 700 words . . . GARMENTS THAT HAVE

BEEN WORN cannot be returned for credit to the store where they were purchased, when they are fitted with a novel wear-detecting strip devised by Ira I. Slo-



mon, of Long Island City, N. Y. Impregnated with chemicals and temporarily covered with an impervious material, the strip is sewn to a garment, say, for example, at the neck line of a dress. When the garment is sold, the protective covering over the strip is removed. If the garment is worn for any extended period, body heat reacting on the chemicals will cause the strip to change color, indicating that the garment has been worn, and making it impossible for the purchaser to return it to the store. If the whole strip is ripped off by an unscrupulous customer who plans to wear the dress and then sew the strip back on before returning it, she finds that a special telltale thread was used for the strip-sewing operation, and she is unable to duplicate it. This clever invention is expected to help stop the practice of "buy-

ing" a garment and wearing it for a day or an evening with no intention of keeping or paying for it . . . CURIOUS WORDING OF THE TITLE of patent 2,158,607: "Thread Twisting Off Device On Double Twist Twisting Machines" . . . WITH THE APPROACH OF WINTER, croquet fans can transfer their activities indoors by using wire wickets developed by L.



Julian Smith, of Long Beach, Calif., for use on rugs and carpets. The wickets have circular feet fitted with slender spurs that pro-

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hooks, and a lot of other messy equipment. So it was, but that vision is fading out nowadays. For a new and simple method of electroplating has been perfected, especially adaptable for use in the home, or shop, or store, or office, and in many other places, too. And



This new electroplating outfit is as easy to pick up and carry around as a fishing tackle box.

therein lies a newly found way for a man to fatten his pocketbook.

Thanks to modern science, the new electroplating process does away completely with all tanks, and permits easy portability of the entire plating outfit. The process uses an electric brush and a non-liquid electrolyte.

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How Eight Men Cashed In

And has somebody hunting for spare time dollars or full time ones for that matter, actually used the process to his profit? Listen to this:

"I got a typewriter rebuilding company to let me go over 100 machines. And then a jewelry loan company gave me an order for replating their musical instruments. I have even gone into a home to plate some faucets and made \$10.00 in three hours," says W. R. Dixon, 217 Admiral Blvd., Kansas City, Mo.

"Three pairs of automobile reflectors netted me five dollars, the plating costing seventy-five cents," remarks Francis Edwards, St. Clair, Pa.

"I have gold plated to date more than sixty rings at seventy-five cents each," reports Charles N. Valade, Tupper Lake, N. Y.

"As a watchmaker, it formerly cost me \$1.50 to have a watch dial refinished," writes Charlie M. Underwood, Turlock, Calif. "Now it costs me two cents for the compound."

Adv.

"As a maker of stage props, I often had to take devices apart for plating," reports Fred Corwey, 315 West 47th Street, New York, N. Y., "but now I do not have to take them down and send the parts out, I do it on the spot."

"As a sideline I average \$20.00 a week. I put an ad in a paper. Then I arranged to pay a music store owner ten cents on every dollar of work he turned over to me. I had cards printed. I display my work and boy, does the work come in!" So reports Ray Kuhns, Cumberland, Md.

"I use my plater for work on guns and pistols, and all kinds of silverware, and have discarded my old tank," says W. E. Irby, State Line, Mass.

"By replating metal parts on a show case, I made over twice the price of my outfit in three and a half hours," declares Howard Mullorky, 119 Cornelia Street, Plattsburg, N. Y.

Want any more evidence, young man? There's plenty to be had. But a word to the wise—well, you know the rest of it.

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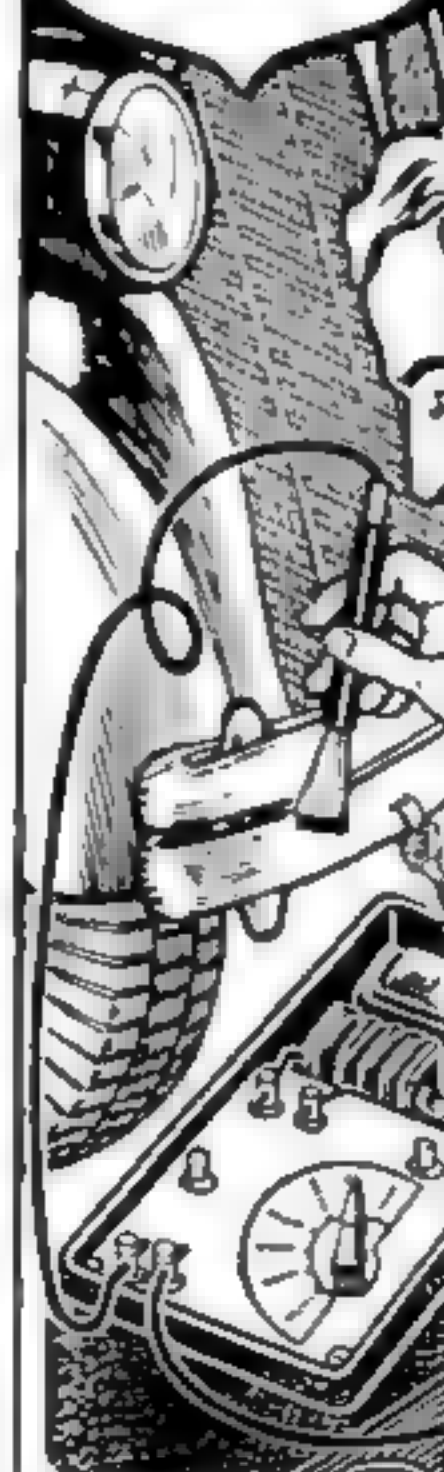
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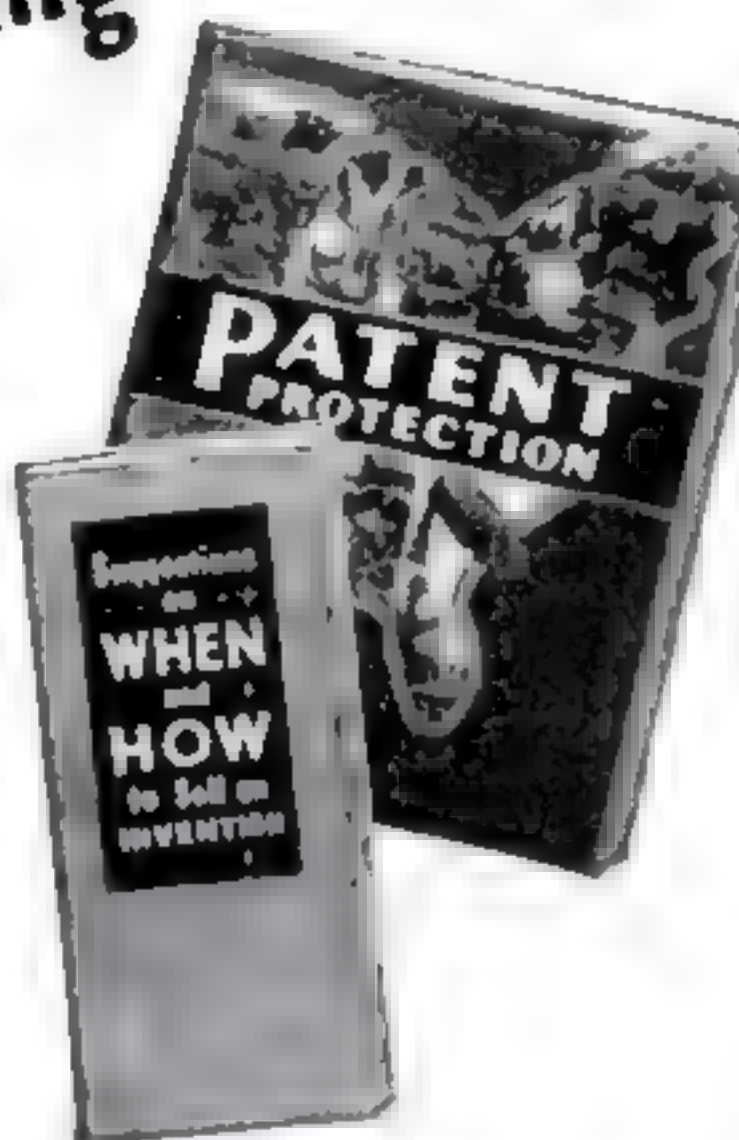
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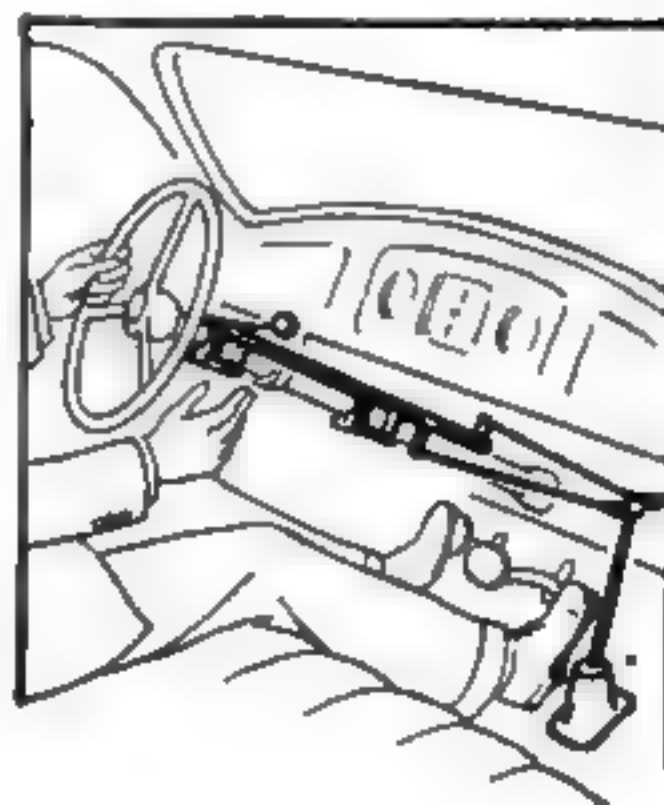
(Continued from page 30)

ject into the rug fabric to hold them upright ... A NEON TUBE FLASHES on the dashboard of a car to warn its driver that the water in the battery has dropped below a safe level, in an indicating system worked out by Herbert S.



Polin, of Sands Point, N. Y. Easily installed in any car, old or new, the battery-water indicator is operated by the car's ignition circuit. If connected by way of a spark plug, the warning light will flash intermittently with each discharge of current across the spark plug's air gap ... ALTHOUGH A COMPLETE LIST of all attorneys authorized to practice before it

is kept on file, the U. S. Patent Office will not recommend or in any way aid an inventor in his selection of a patent attorney ... A HANDY piece of furniture to have when a card party is planned, or a number of guests drop in, is a sofa designed by Axel Olson, of Brooklyn, N. Y. Hollowed ends house eight collapsible chairs and two folding tables ... TO MODERNIZE CARS that have a gearshift lever extending up from the floor, Baldwin Kuntz, of Juneau, Wis., has developed a mechanical device that is attached to the steering column and allows a driver to shift gears by means of a lever



just under the steering wheel, as in many of the latest cars. The steering-wheel lever actuates the regular shift lever on the car floor by means of connecting rods and a movable shaft mounted on the steering column ... THE PATENT OFFICE RECOMMENDS that an inventor be fairly sure

that he can realize a profit before taking out patents in foreign countries. It warns that in addition to the initial fees, patents in most foreign countries are taxed on an annual or other periodic basis, and that the fees increase in amount with the passage of time, so that a foreign patent frequently becomes a financial burden. Inventors there-

(Continued on page 34)

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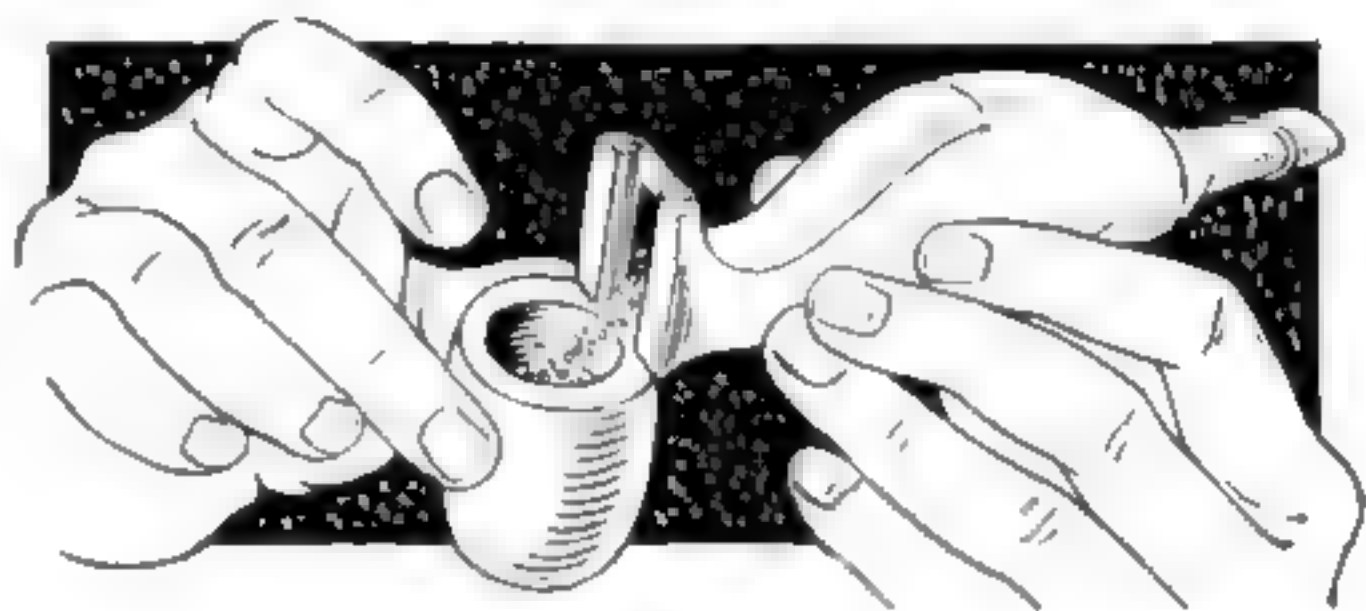
With the Inventors

(Continued from page 32)

fore would do well to consult a competent attorney before applying for a foreign patent. Otherwise, the Patent Office points out, they may find themselves saddled with heavy fees which are not justified by the returns



... "I WONDER WHETHER THE BABY IS warm enough, or whether I should put on an extra blanket?" That query, asked daily by thousands of mothers, is precisely answered by an invention of Sidney K. Meyer, of Detroit, Mich. A thermometer attached to the outside of the baby's crib is controlled by a heat-sensitive liquid inclosed in a tube that is placed under the bed covers. One glance at the outside scale will tell the mother the exact under-the-covers temperature in her baby's crib... THE TONGUE-TWISTING patent title of the month is a drawn verbal battle between "Tetrahydrofurfurylaminonaphthalene Compounds" and "C-Aliphatic Isocyclic Amines N-Substituted By Oxyaliphatic Radicals"... A PIPE THAT HAS a built-in tobacco pouch is the unusual invention credited to Walter W. Bernard, of Greeneville, Tenn. Between the bit and the bowl of the pipe is a chamber having a hinged top and designed to hold enough loose tobacco for a number of pipefuls. When the pipe bowl is pushed downward as shown in the illustration, an opening into the storage chamber is exposed, making it easy to pour or finger the tobacco directly into the bowl.



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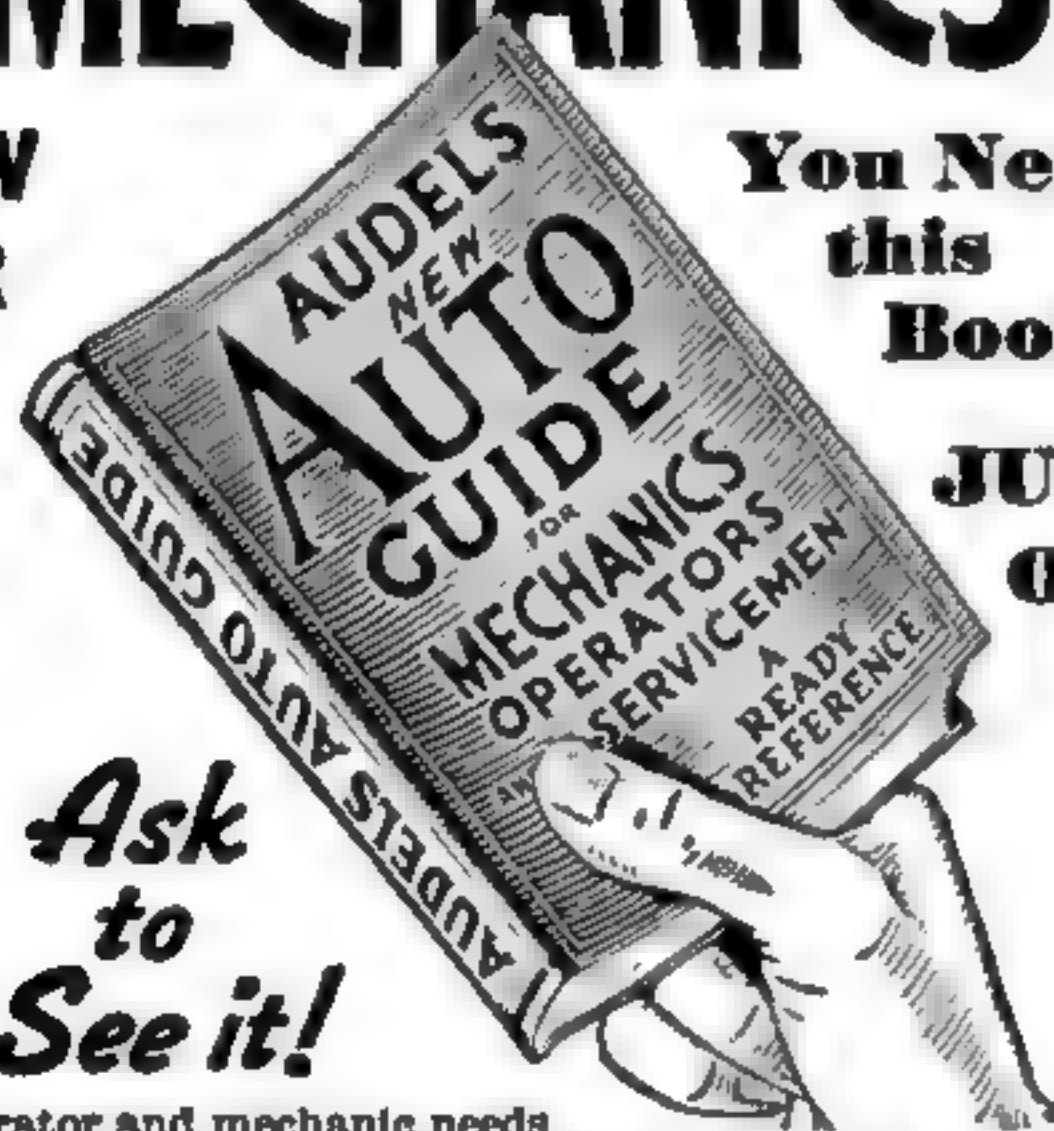
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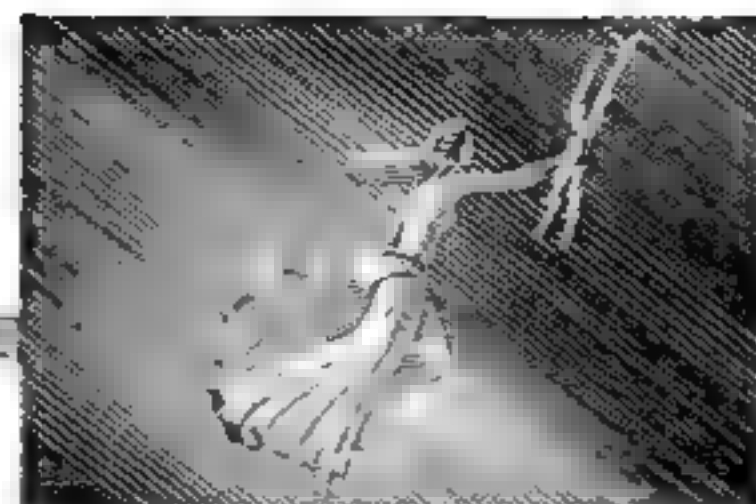
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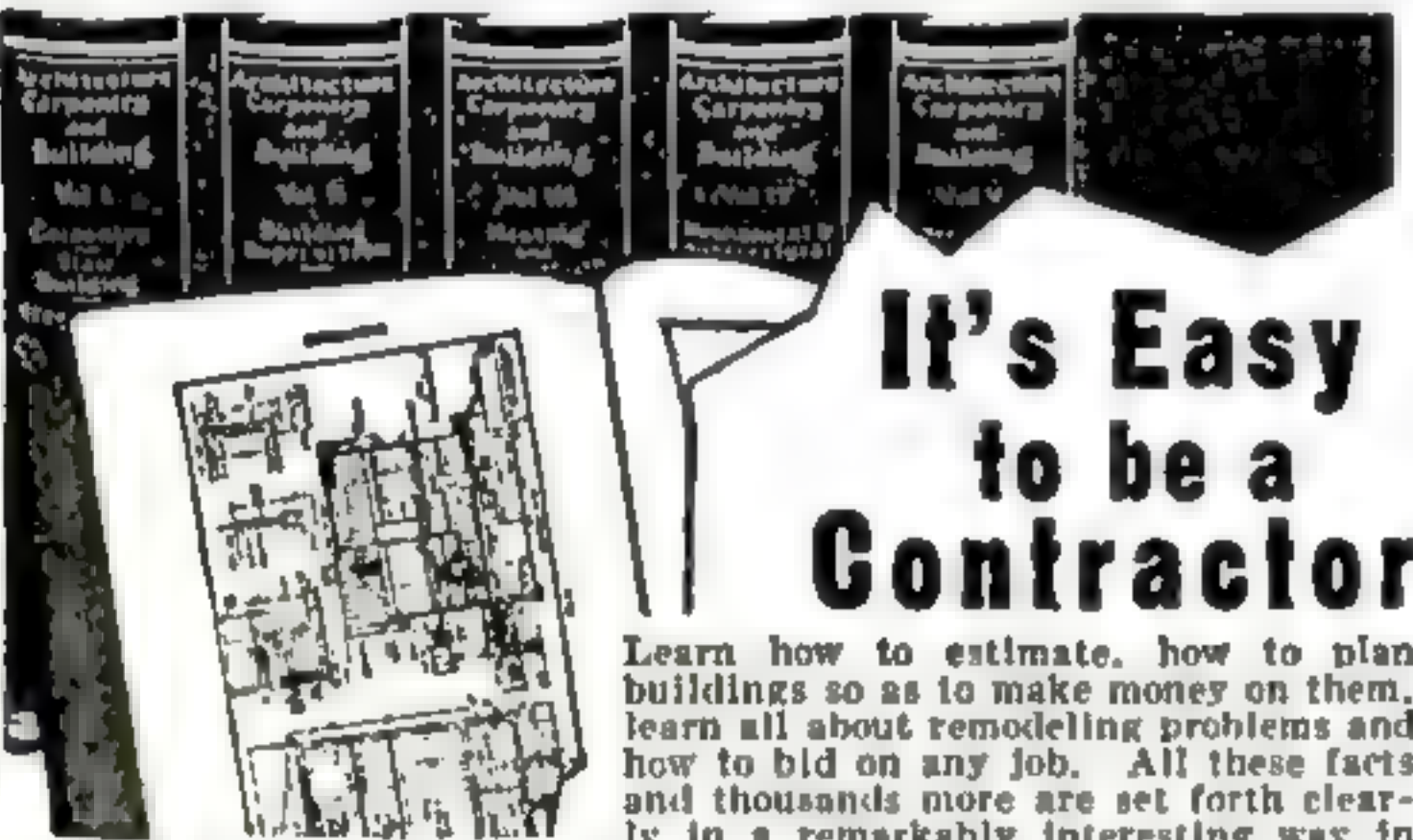
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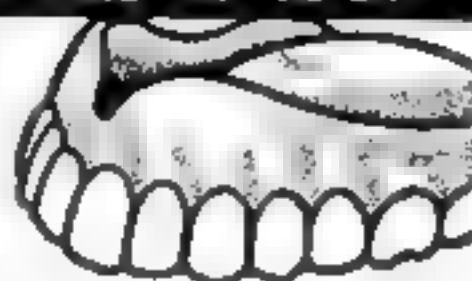
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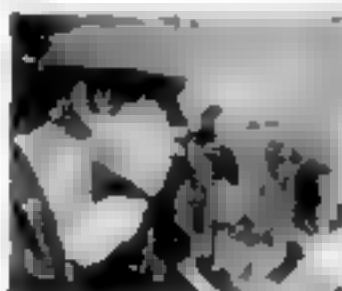


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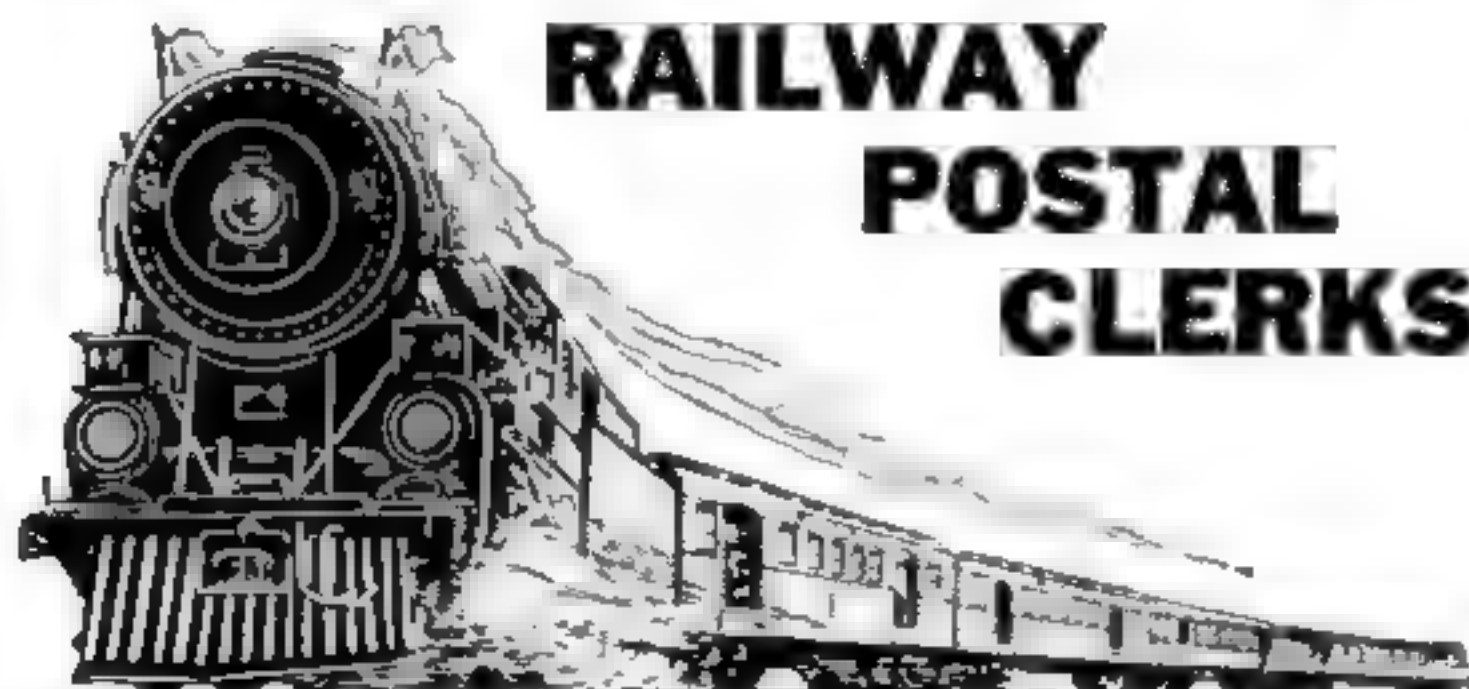
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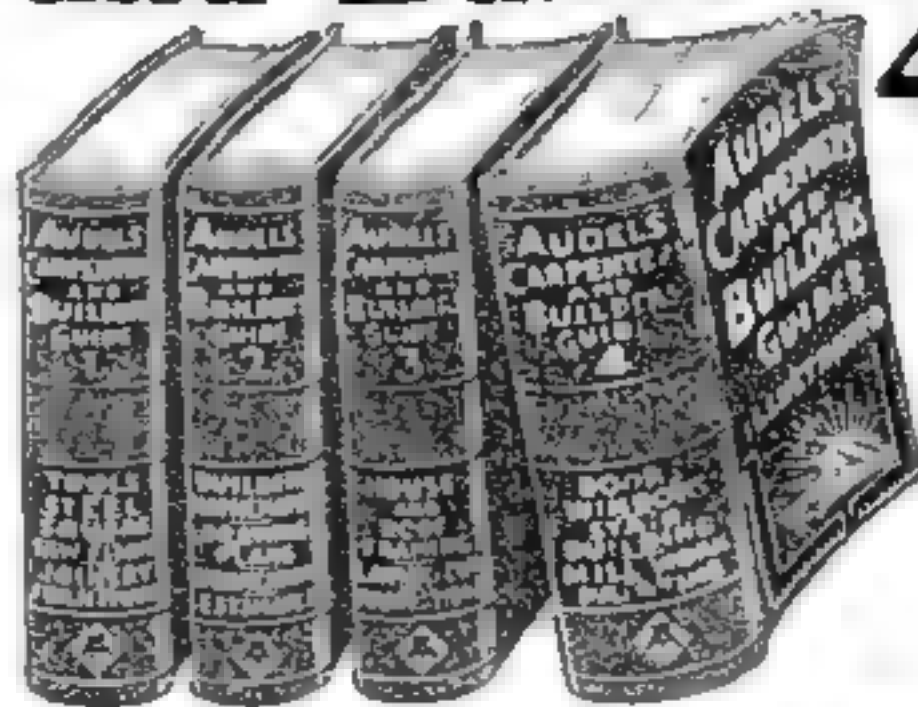
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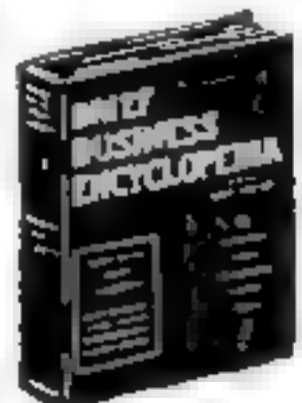
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SILVER Jubilee. Panama honors 25th anniversary opening Panama Canal. Five beauties 5c with approvals. Stanley Melzer, 3120 South Adams Ave., Milwaukee, Wis.

SIX dollars for 9c! 300 different stamps (Cat. price \$6.00) only 9c with approvals. Tatham Stamp Co., Springfield-50, Mass.

FINE Approvals, freshly filled books and sheets. Tell me what you want and I will send them. Skinner's, 306 East Fourth, Long Beach, Calif.

UNPICKED Mixture: 40c pound, (5 lb. \$1.50). 100 U. S. revenues 10c! (750, 50c) 100 different Roumania, 35c. Vanvoorheis, Hyndman, Penn.

FREE Trinidads catalogued \$1.40. If you request approvals and send dime. Colonial, Box 554 Place d'Armes, Montreal, Canada.

UNITED States stamps on approval. Selections correctly numbered, reasonably priced. Southern Stamps, Box 70, Miami, Fla.

FREE. 25 different Czechoslovakia to approval applicants. 3c postage. Theodore Stevens, 3576 Maryland Ave., Detroit, Mich.

SURPRISE Premium Given. 1075 different. World Wide; \$1.85. Charles Roessle, 479 East 144 Street, New York, N. Y.

NEVER offered before. 21 French Colonies, pictorials, sets of 5 each (105) for 35c. French, 241 Euclid, Cleveland

2 POUNDS Unpicked U. S. Mission. \$1.00. One pound 55c. Vincent Conner, Randolph, Hagerstown, Md.

FREE! Two coronation sets. Postage 3c. Roberts, 312U Shearer Bldg., Baycity, Mich

SELL Stamps, earn cash commission. Everglades Stamps, Box 703, Miami, Florida.

ZEPPELIN Hindenburg set 5c Approval applicants only. Quality Stamps, Englewood, Colorado.

FREE! 3 Different Triangles, with approvals. Rosenberg, 3527 Adams, Chicago

FREE! 20 Different pictorials to approval applicants Hunziker, Box 225-AS, Minneapolis, Minn.

20 DIFFERENT Commemoratives 3c to approval applicants. Dolve, Box 406-P, Minneapolis, Minn.

TRIANGLES. Seven different 15c. Approvals. Lists. Premiums. Colony, Hillsboro, N. C.

PENNY Approvals thousands of fine stamps at 1c each. Heiden, 530A Parkside Ave., Brooklyn, N. Y.

50 FREE. Iraq, Iran, etc. Postage, 1c. Album 3c. Bullard, 268D Northampton, Boston, Mass.

25 BRITISH, French, Portugal Colonies to approval applicants sending postage. Star Stampco, Lima, Ohio.

1000 MIXED foreign, 25c. Well worth sorting for values. Plaza Stamp Co., Santa Fe, N. Mex.

WILL Rogers commemorative airmails complete 5c. Approvals. Creevey, Berwick, Penna.

REVENUE Packet free. Approvals. Send stamp. Music Box, Broad St., Pawtucket, R. I.

50 ANIMALS, Railroads, Ships, Maps, etc. 10c with approvals. R. Buchanan, Box 40, College Point, N. Y.

FREE! Ten military occupation and local stamps. Approvals. P. Lindgren, 714 Market, San Francisco.

BOLIVIA, 110 different \$1.00; 150 \$2.00; 190 \$4.00. Carlos Gerke, Sucre, Bolivia.

150 GENUINE foreign stamps, 5c. coin. Elvin Stanton, Niantic, Conn.

THREE sets for three cent stamp! Jack Reed, Houtzdale, Penna.

FRENCH Colonies, 500 different, \$2.00 Lecomte, Frere Orban, Jumet, Belgium.

PANAMA Canal first-day cover; approvals, 5c Box 26, Ogden, Utah.

FREE! U. S. 1891 cover with general approvals. Stampcraft, Sanford, Fla.

PENNY Approvals that please. Haywood, 395 Adams St., Pomona, Calif.

175 MIXED Stamps 3c with approvals. Dawson, 1308F, The Dalles, Oregon.

100 DIFFERENT Caribbean stamps, \$1.00. Ana Gray, Kingshill, Virgin Islands.

BRAZIL, 50 different 10c with bargain approvals. Davis, Silver Lake, Ind.

FREE. 25 Different Yugoslavia with approvals. Lincoln, 5535 May, Chicago.

6 OLD U. S. 2c to approval applicants. Livings, 3512 Haynie, Dallas, Texas.

NYASSA Pictorials, five airmails. 3c. Altone, 2068 Daly, Bronx, New York.

PENNY up approvals by countries. Hantschek, 180 South Ogden, Buffalo, N. Y.

SURVEYING INSTRUMENTS

FACTORY Rebuilt transits and levels for sale or rent. Cash or easy terms. We will repair, trade in or buy your old instruments. Write for list PS49. Warren-Knight Co., Manufacturers of Sterling Surveying Instruments, 136 North 12th St., Philadelphia, Penna.

TATTOOING SUPPLIES

AMATEUR Tattooing outfits, 25c illustrated list. Tatuco, 651 South State, Chicago.

TATTOOING Outfits, supplies, illustrated list free. Percy Waters, Anniston, Ala.

TAXIDERM

LEARN by mail to mount birds, animals, fish, game heads Tan skins, make leather, all in one easy course. Old reliable school, founded 1903, over 250,000 students. Rush postal for Free 48 page book, tells all about it. Very low tuition fee right now. Address Northwestern School of Taxidermy, 339 Elwood Bldg., Omaha, Nebr.

TYPEWRITERS, OFFICE DEVICES

TYPEWRITERS, adder, mimeograph, multigraph, addressograph. Send for free lists of machines that will help you at half price. Pruitt, 28 Pruitt Bldg., Chicago.

VOCATIONAL GUIDANCE

YOUR Place in life. 22 experts analyze vocations insuring success, security, independence. 128 pages. Over 500 references. Send 25c coin. Trail Blazers, 200 Park, Champaign, Ill.

WANTED—MISCELLANEOUS

CASH for used Scientific instruments, microscopes, cameras, shotguns, etc. Write details. Elman's, 2300-PS VanBuren, Chicago.

USED Delta saws, drill presses, etc. Write Edward Smith, 102 Monroe St., Brooklyn, N. Y.

WELDING

75-200 AMPERE Arc Welders from Dodge generators. Complete plans 35c. 100 other generator changes. LeJay Manufacturing, 323 LeJay Building, Minneapolis, Minn.

BUILD your own d.c. arc-welder from light plant, automobile generators, or d.c. truck motors. Welders Club, WB-3432 M-Mart, Chicago. For sale: D.C. truck motors.

GENUINE Arc-Welding from any 32 volt battery lighting system. Economical, easily built. Plans \$1.00. Pulis & Johnson, Balke, Okla.

DEMONSTRATORS, electric arc welders. Money saving prices. Used by the government. Trial and terms guaranteed. Hobart Welders, Box P-1093, Troy, Ohio.

REBUILT a.c. d.c. Arc welders, all sizes; engine governors, idlers. Terms. Low prices. Guaranteed. Service Co., 3732 Cedar Ave., Cleveland, Ohio.

CUT ME OUT

Cut me out, paste me on a postcard and mail to Popular Science Monthly, Dept. 109, 353 Fourth Ave., New York, N. Y. I'll bring you complete supplies and instructions on how to make easily several dollars a week in your spare time.

BARGAINS!!! Used Home-Study Courses BOUGHT-SOLD-RENTED

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ILLUSTRATED
CATALOG
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Write today for big FREE illustrated catalog explaining this amazing service. Used correspondence courses and educational books on every subject. 100% satisfaction guaranteed. We buy for cash—we offer unbelievable bargains. Send your name on penny postcard at once! No obligation.

NELSON CO.
K-202 Manhattan Bldg.

Chicago

DON'T BUY—SAVE \$ \$ \$

ON RADIO SETS—PARTS, TUBES, PHONOGRAPH RECORDS—UNTIL YOU HAVE SENT FOR OUR NEW GIANT MONEY-SAVING CATALOGUE.

UNITED RADIO COMPANY, DEPT. Z, NEWARK, N. J.



AIR CONDITIONED KUSHIONTRED SHOES!

EARN BIG COMMISSIONS AND
YOUR OWN SHOES AS BONUS

Steady income all year showing outstanding new Fall line—Men's, Women's, Children's Shoes, 200 styles including wonderful Cushion Sole shoes and amazing Groflex shoes that need no breaking-in. \$10,000 Bond establishes confidence. Offer shirts, ties, hosiery as bonus to customers. We pay postage. No experience needed. Case of actual shoe samples without cost. Write TODAY for full information, money-making plan and FREE selling kit.

TANNERS SHOE CO.

454 Boston, Mass.

**WRITE FOR
FREE OUTFIT**

You need Balanced Gasoline

PICK-UP
IN TRAFFIC

+

POWER
ON HILLS

+

MILEAGE
ECONOMY

Mobilgas
Gives
Balanced
Performance

ADD UP WHAT YOU GET when you buy Mobilgas: not only excellent mileage, pick-up, power and pep...but a clean, smooth-running engine, too... real *carefree, economical* driving!

The reason? Mobilgas is refined to atomize quickly...to burn evenly. It's scientifically cleaned. Every drop is selected for high octane value!

You get "Balanced Performance"...all good qualities *in full measure!* Socony-Vacuum Oil Co., Inc.



MOBILGAS

The Balanced Performance

POPULAR SCIENCE

Monthly

RAYMOND J. BROWN

Editor

Uncle Sam Arms Against the World

WITH lightning speed, the enemy has struck at America. A "suicide squadron" of bombing planes has roared out of the sky to rain their missiles upon the Panama Canal. Before a lucky hit could strike their target, the towering lock gates, a hail of antiaircraft fire has riddled them. The few pilots who escaped have bailed out over Central American jungles—knowing that, before they could get back to their aircraft carrier, our own bombers would locate and sink it.

The attempt to bottle up our fleet in the wrong ocean has failed, and now the hostile coalition of powers has dropped its mask. It is war, without the old-fashioned ceremony of a formal declaration—swift, ruthless, modern. Somewhere at sea this evening, with



Our first and second lines of defense: Below, the majestic warships of the battle fleet; above, a mighty twelve-inch coast-defense mortar speaks defiance to would-be invaders far out beyond the sandy shoreline





American doughboys of the future will go into battle with improved automatic-type rifles like the one being tried out at the left. Below is a mobile antiaircraft gun of the latest design, which can be towed at forty miles an hour to meet a threat of a raid

only blue battle lanterns alight, our fleet is steaming out to meet the approaching armada of the Black Alliance. Here at home, in this blacked-out seaboard city, Army tanks and artillery caissons go rumbling through the darkened streets, and the luminous fingers of giant searchlights probe the sky for raiders from beyond the border.

Thus may come "M day," the country's fateful day of mobilization. But any such challenge from overseas is being made unlikely—and our victory, if it does occur, as nearly certain as human foresight can provide—by the most powerful fighting machine America has ever forged in peacetime. Already off to a flying start, the gigantic armament program voted by the "Preparedness Congress" of 1939 will make the United States more than a match for any conceivable combination of aggressors. And, keeping pace with latest styles in warfare, it will provide weapons more radical and deadly than any battlefield yet has seen.

Already swollen to peacetime records, "regular" Army and Navy appropriations are boosted by a half-billion-dollar "emergency"



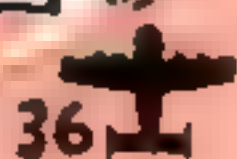
fund called for by the President at the beginning of the year, bringing the total voted for national defense by the last Congress to a figure approaching \$2,000,000,000.

Most spectacular of the "emergency" items, more than a quarter of a billion dollars for the Air Corps will give the Army 5,500 fighting planes—well over double its present strength of about 2,300 machines. New aircraft will range in size from monster "flying fortresses" to sleek "pursuit" and "pursuit-interceptor" planes.

First orders for 1,000 planes include two "hush-hush" single-seater designs—as futur-

Advance Alaskan base to intercept attack from Asia by northwest route

KODIAK

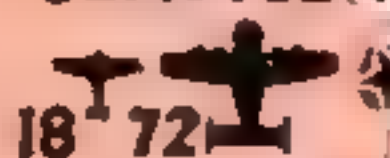


Second line of Alaskan defense and way station from Seattle to Kodiak

SITKA

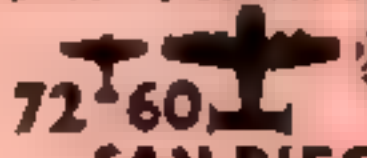


SEATTLE AREA



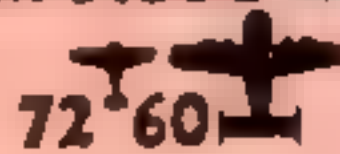
Major Northern bases

SAN FRANCISCO AREA



Major Central bases

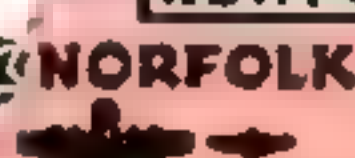
SAN DIEGO



Major Southern bases

NEWPORT AREA

NORFOLK AREA



JACKSONVILLE



PUERTO RICO

"Hawaii of the Atlantic" will guard eastern approach to Panama Canal and turn Caribbean into an "American lake"

Outpost of air patrol ranks second only to Hawaii in strategic importance

MIDWAY I.



JOHNSTON I.



HAWAII

World's strongest maritime fortress guards west coast of U.S.

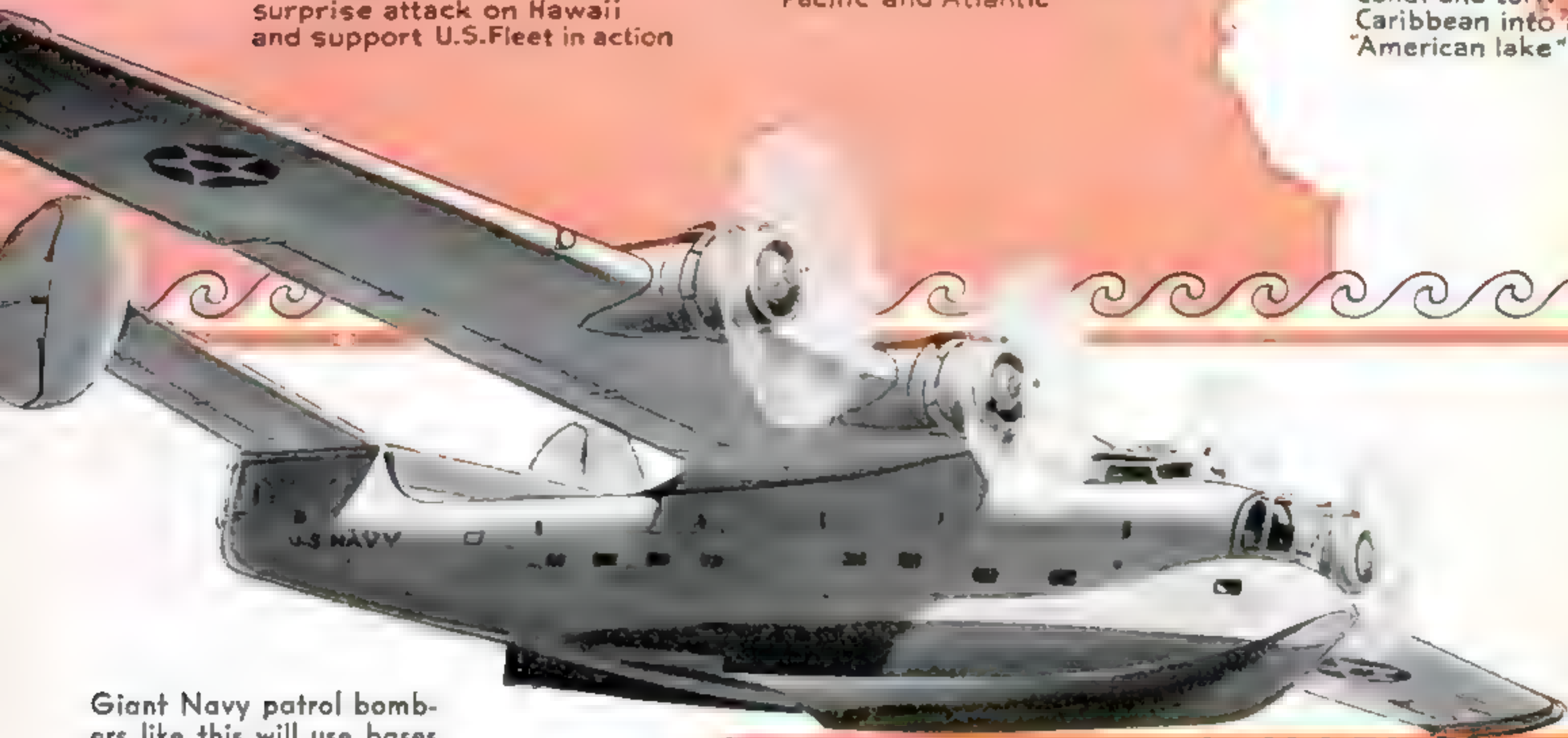
PALMYRA I.



Warning stations to detect surprise attack on Hawaii and support U.S. Fleet in action

CANAL ZONE

Panama Canal base defends "life line" of U.S. Fleet between Pacific and Atlantic



Giant Navy patrol bombers like this will use bases shown on the map at top of page. Below, even a tiny coral atoll can serve as a base

istic as rocket ships, so streamline that they must be piloted by men with the stature of jockeys. One of the world's first twin-motor pursuit craft, the Lockheed XP-38 places the pilot-gunner and his nest of deadly machine guns between a pair of wasplike hulls inclosing two liquid-cooled 1,000-horsepower motors. Its top speed is an official secret; on less than full throttle, it is known to have exceeded seven miles a minute. The Bell XP-39, a sister craft of the XP-38, carries



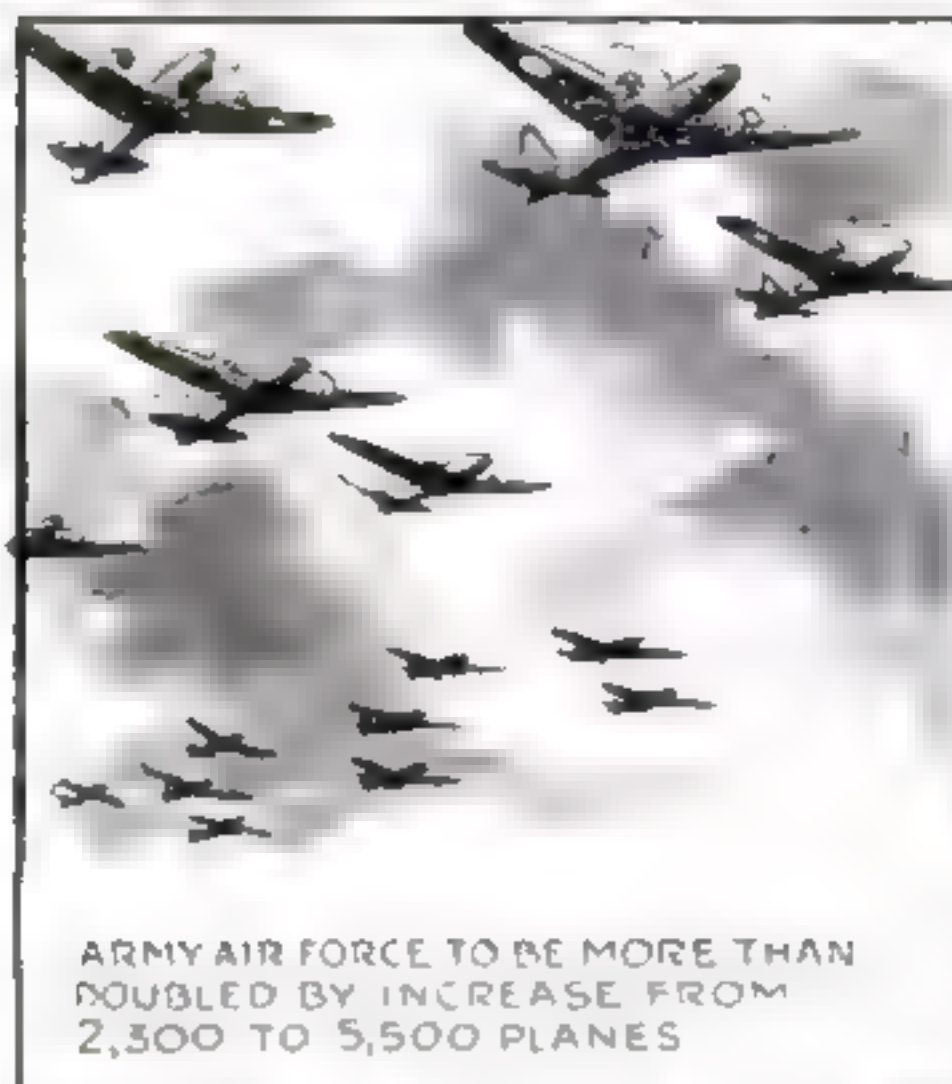


One of the Army's new "hush-hush" pursuit planes, the twin-engined Lockheed XP-38, which has a speed of more than seven miles a minute

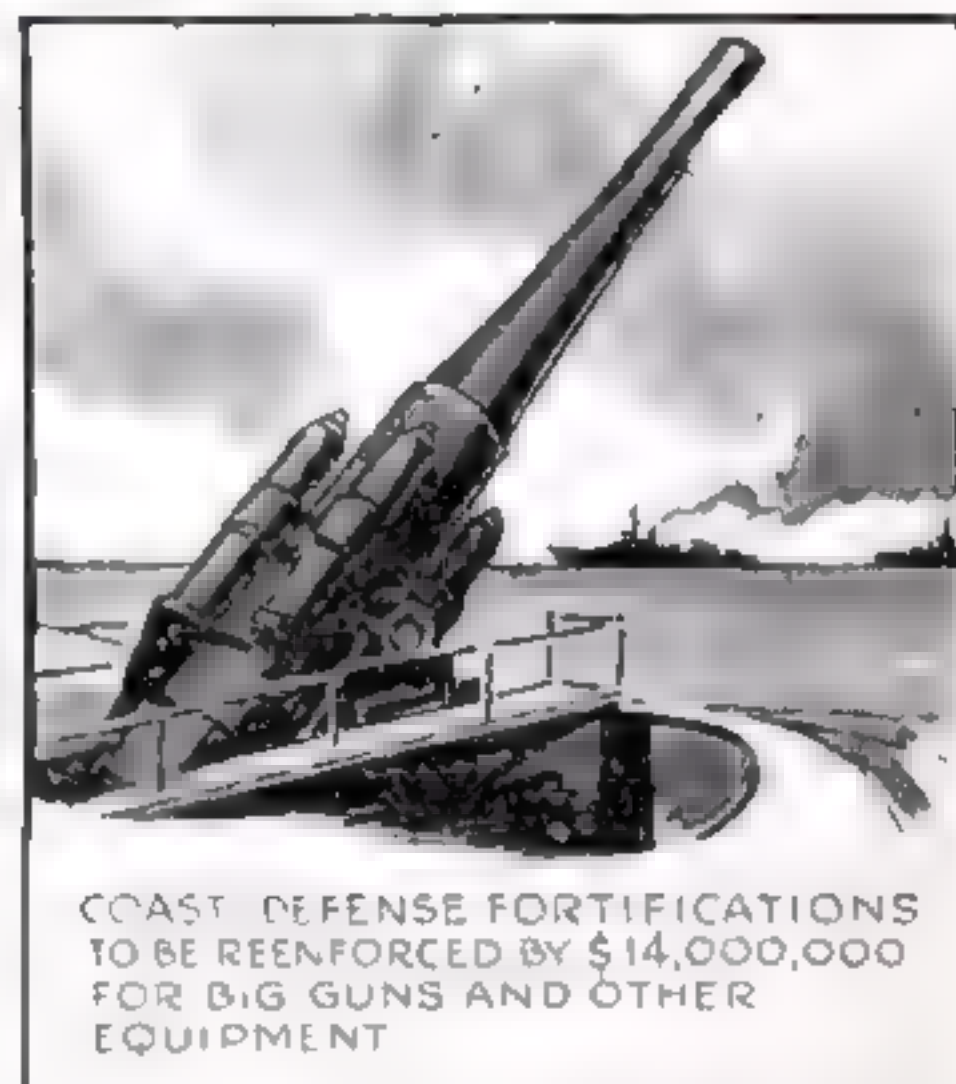
a cannon fired by electricity.

Thundering sixteen-inch guns that can hurl a 2,100-pound projectile at a battleship twenty-five miles offshore, railway artillery that can be rushed to any threatened harbor and fired from the tracks, mobile three-inch antiaircraft artillery of the latest model—these are some of the items that will strengthen long-neglected coast defenses. Mines to be planted in harbors in times of emergency, and to be set off by electric switches ashore when enemy vessels pass over them, will also be provided. This year's allowance of \$14,000,000 for coast defense more than doubles the amount spent last year. Hawaii, the Canal Zone, and the Pacific coast have been the principal beneficiaries of previous expenditures; now, in view of present world conditions, the Atlantic and Gulf coasts will share in the program.

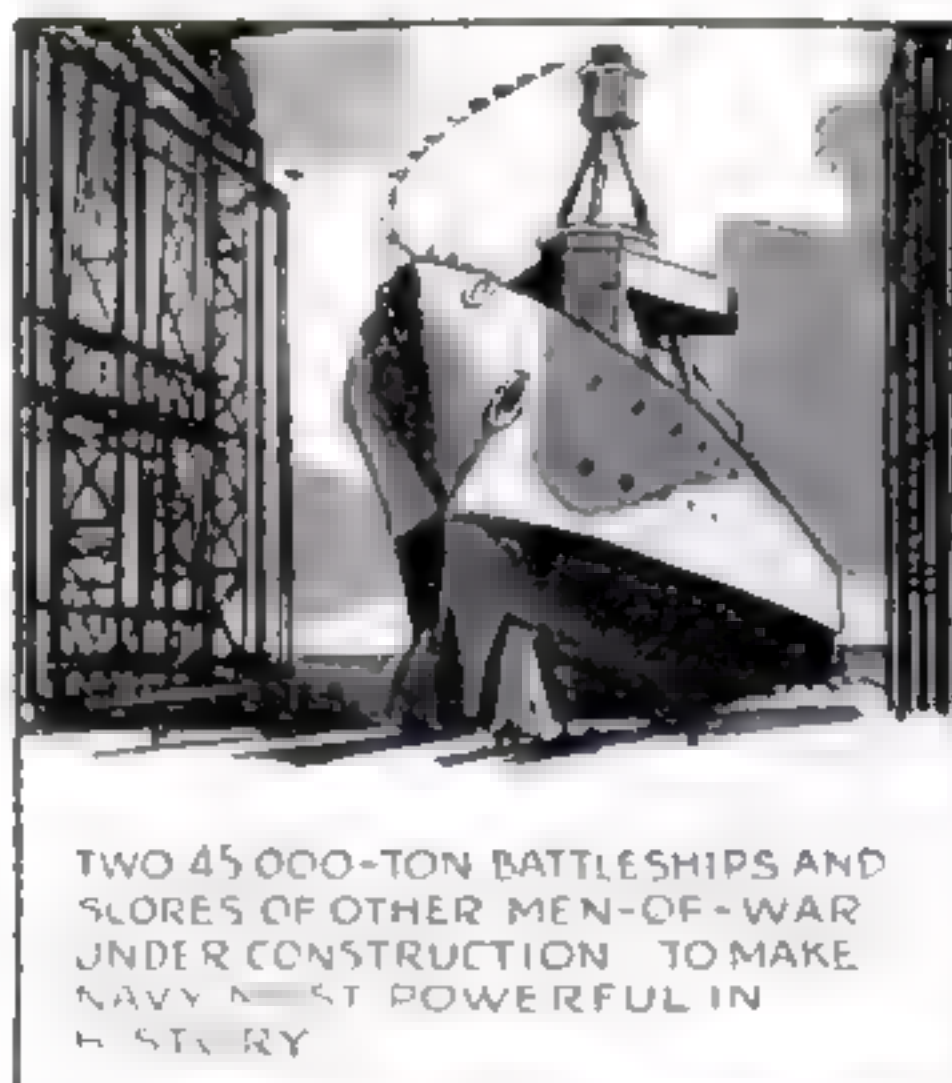
Doughboys will march into the next battle with the deadliest infantry weapon known—the new Garand semiautomatic rifle capable of firing thirty aimed shots a minute, considered the superior of any of its kind abroad. Only a few of our troops carry the Garand gun, so far, but the new arms program includes a rush order for 150,000 of the rifles. Besides these, a \$170,000,000 fund for ordnance will provide critically



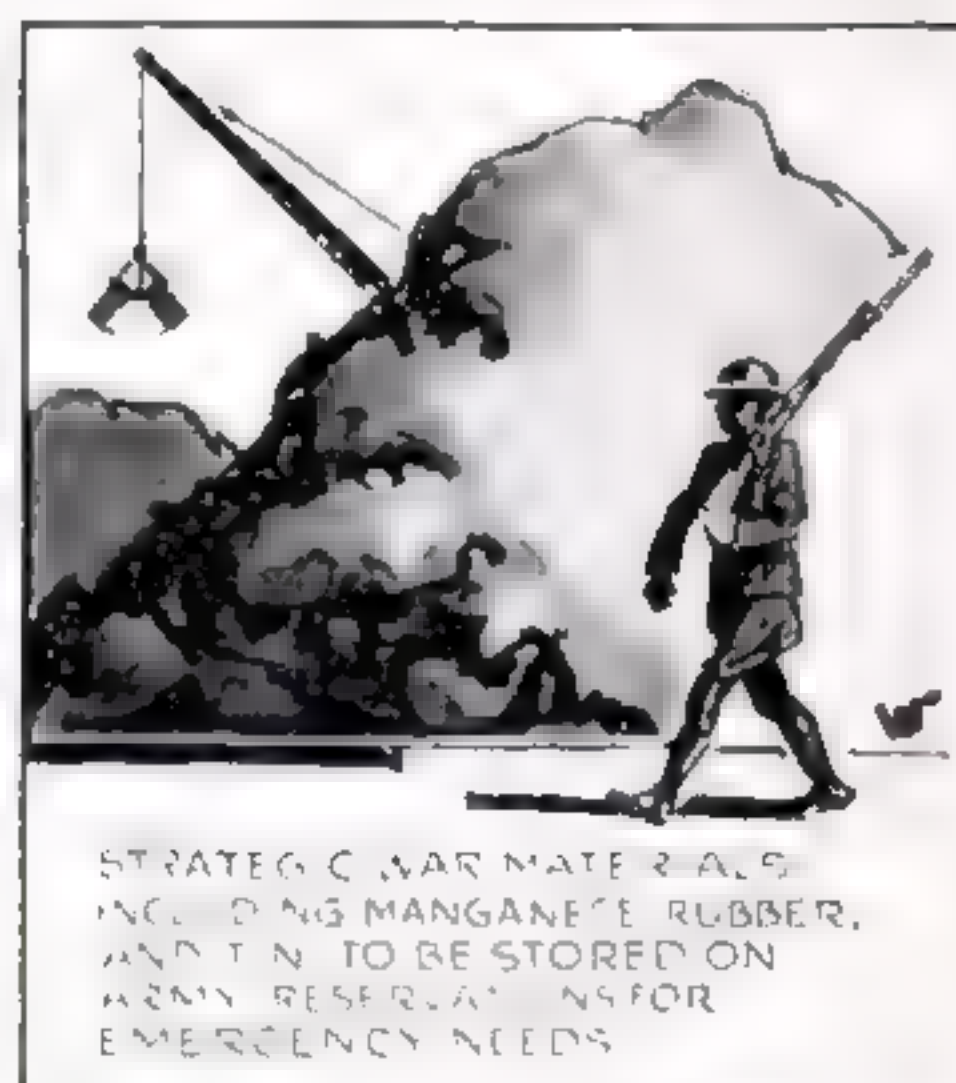
ARMY AIR FORCE TO BE MORE THAN DOUBLED BY INCREASE FROM 2,300 TO 5,500 PLANES



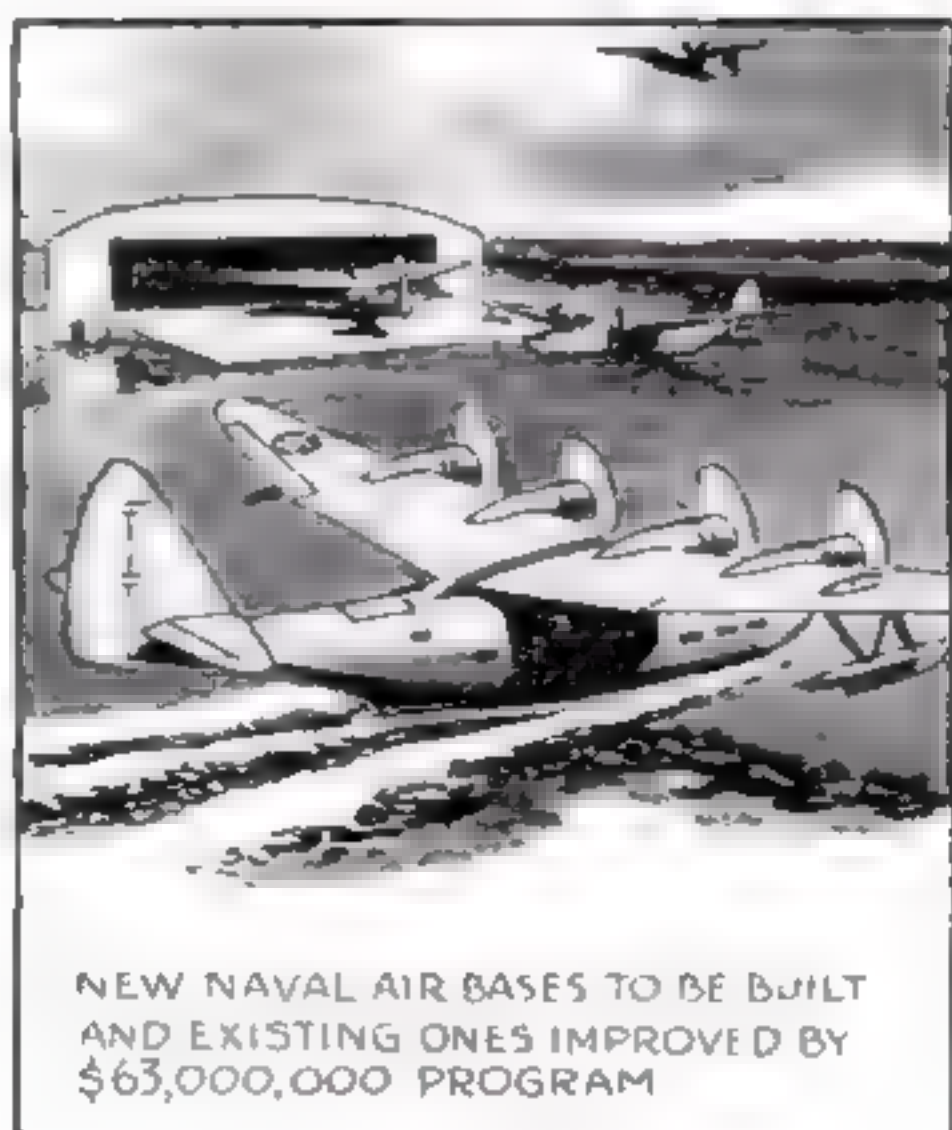
COAST DEFENSE FORTIFICATIONS TO BE REINFORCED BY \$14,000,000 FOR BIG GUNS AND OTHER EQUIPMENT



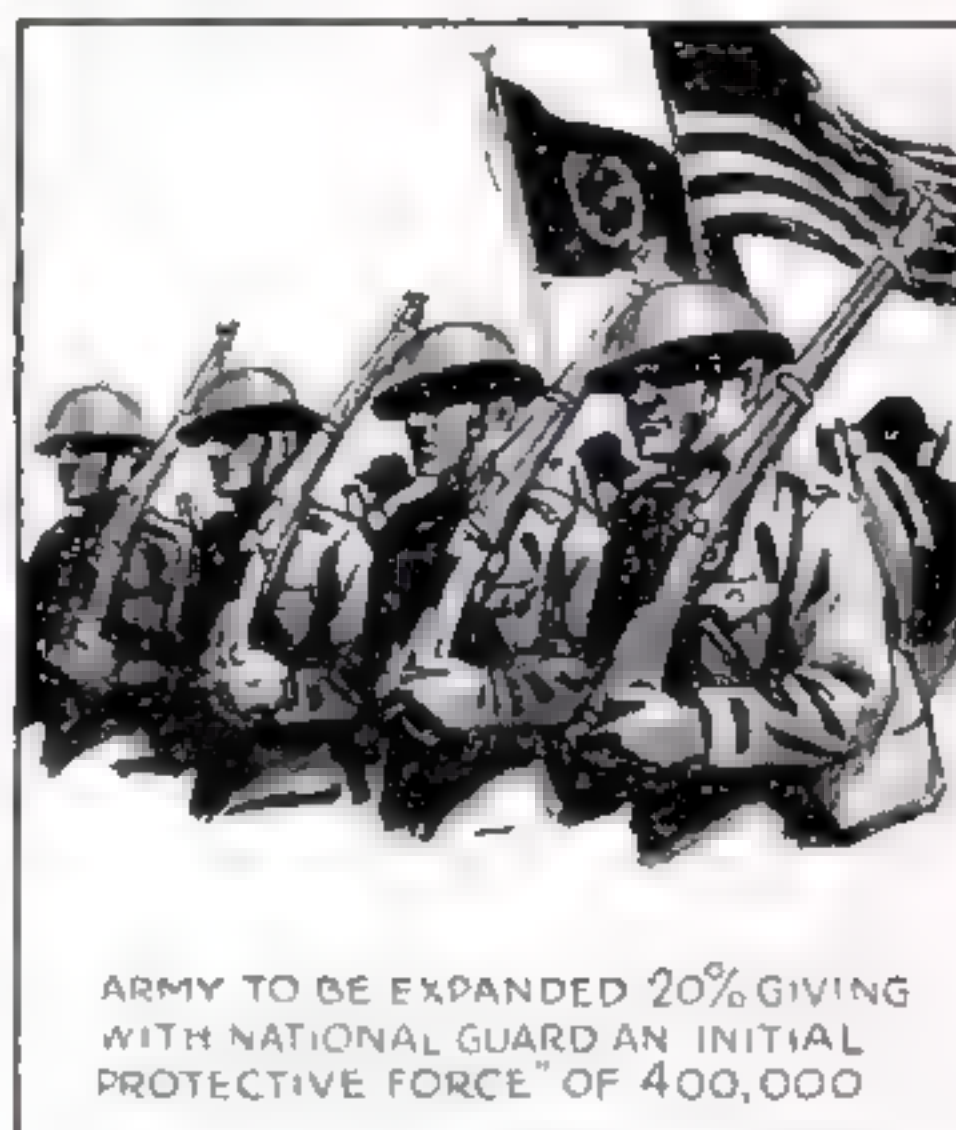
TWO 45,000-TON BATTLESHIPS AND SCORES OF OTHER MEN-OF-WAR UNDER CONSTRUCTION TO MAKE NAVY MOST POWERFUL IN HISTORY



STRATEGIC WAR MATERIALS INCLUDING MANGANESE RUBBER, AND TIN TO BE STORED ON ARMY RESERVATIONS FOR EMERGENCY NEEDS



NEW NAVAL AIR BASES TO BE BUILT AND EXISTING ONES IMPROVED BY \$63,000,000 PROGRAM



ARMY TO BE EXPANDED 20% GIVING WITH NATIONAL GUARD AN INITIAL PROTECTIVE FORCE OF 400,000

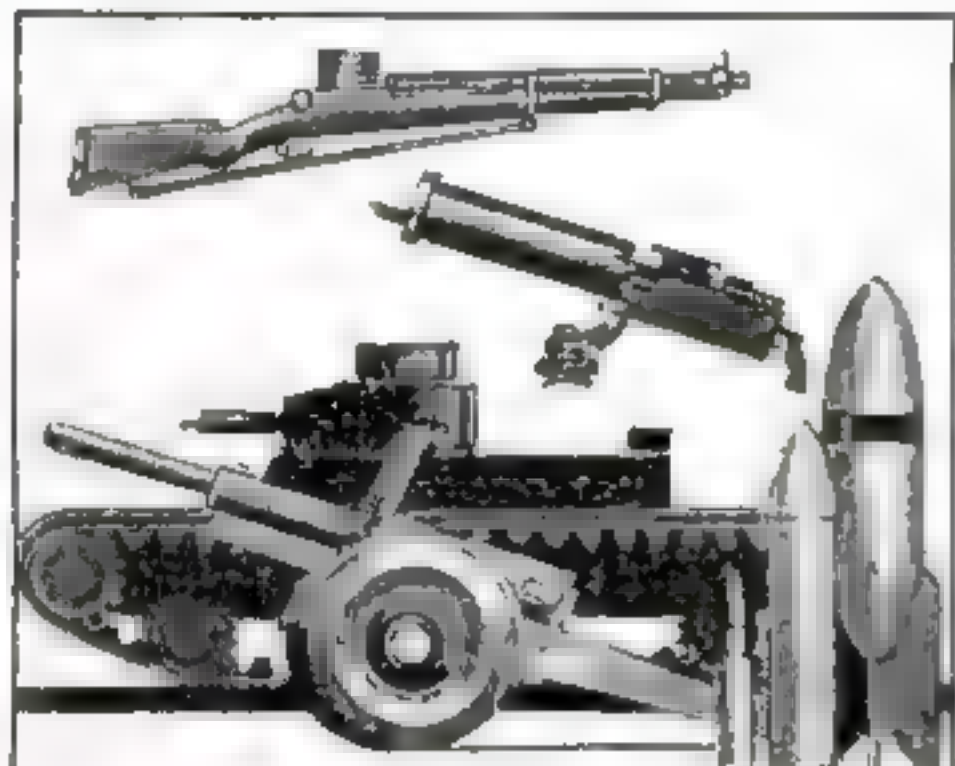
needed war tanks, field artillery, and ammunition of every description. Innovations include a gun that recently hurled a six-inch shell for fifteen miles, a record for standard American field artillery, in a try-out at Fort Bragg, N. C. Another novelty, an antitank gun of new design, fires a 1½-inch shell at such terrific muzzle velocity that it can cripple a heavily armored tank at more than half-mile range. In addition to the ordnance fund, \$4,000,000 will provide the Army with the latest in gas masks—and in poison gases, so that it can dish it out as well as take it.

Men to us these weapons are being sought in the most intensive recruiting campaign since the World War. For the Army is to be expanded more than twenty percent to enlarge the Air Corps, to strengthen our Panama Canal garrison, and for other purposes.

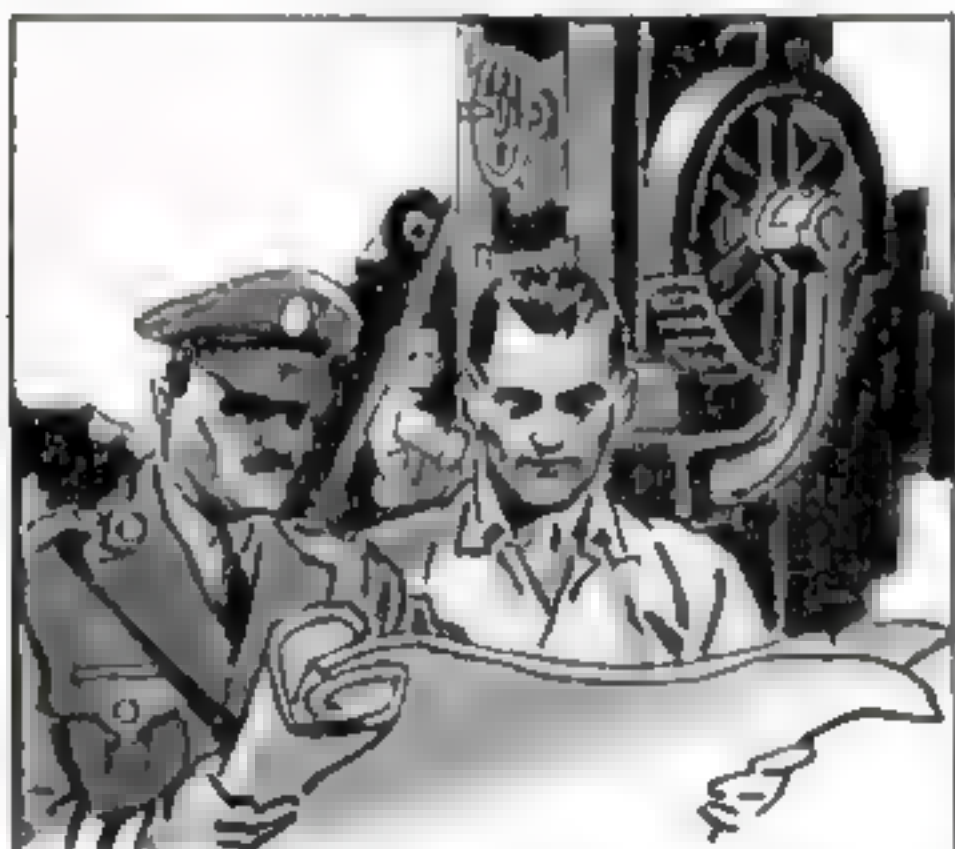
Together with the National Guard, the expanded Army will form a seasoned, hard-hitting "Initial Protective Force" of 400,000 men, instantly available on M day. A second phase of the Army's mobilization plan will quickly train volunteers to expand the I.P.F. to a total "Protective Mobilization Force" of

730,000. If more expansion is called for, selective service would make it easy to fill the ranks of an army of 1,000,000 or more.

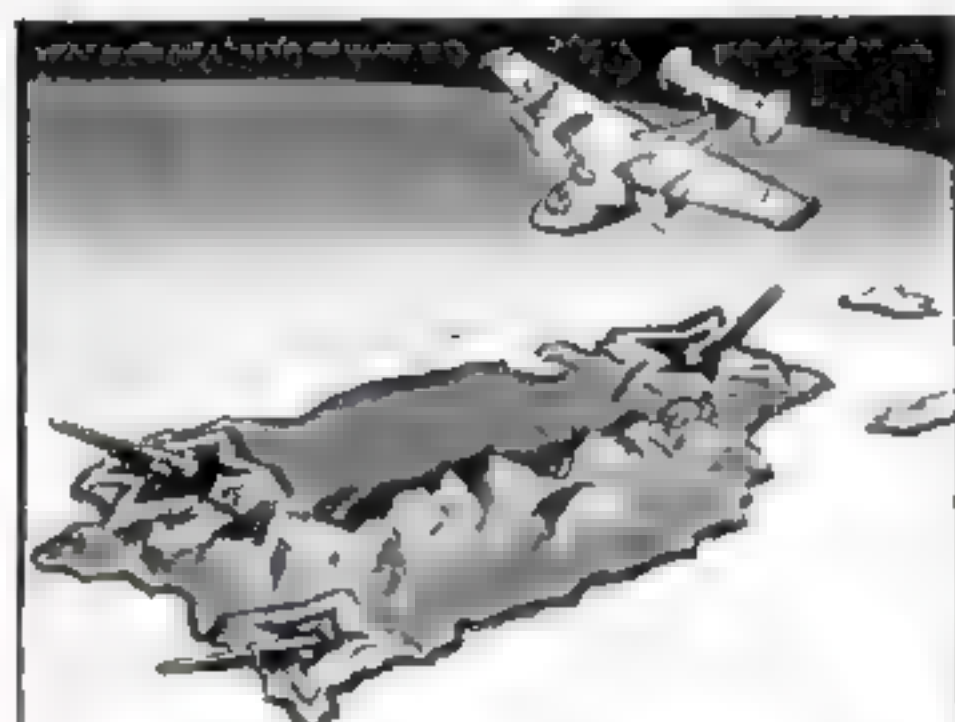
But why all these preparations for land defense, when we have a first-class navy? The answer is that the Navy cannot be everywhere at once. Strategy makes it imperative to keep our men-of-war concentrated, for maximum striking force. So, for instance, the Army's bombers may have to deal with a raiding aircraft carrier—possibly a converted merchant vessel—operating independently of the ene- (Continued on page 230)



\$170,000,000 FOR ORDNANCE AND AMMUNITION TO SUPPLY ARMY WITH SEMIAUTOMATIC RIFLES AND LATEST ARTILLERY AND ANTITANK GUNS



EDUCATIONAL ORDERS TOTALING \$1,250,000 TO TRAIN INDUSTRIAL PLANTS TO PRODUCE COMPLICATED WAR EQUIPMENT



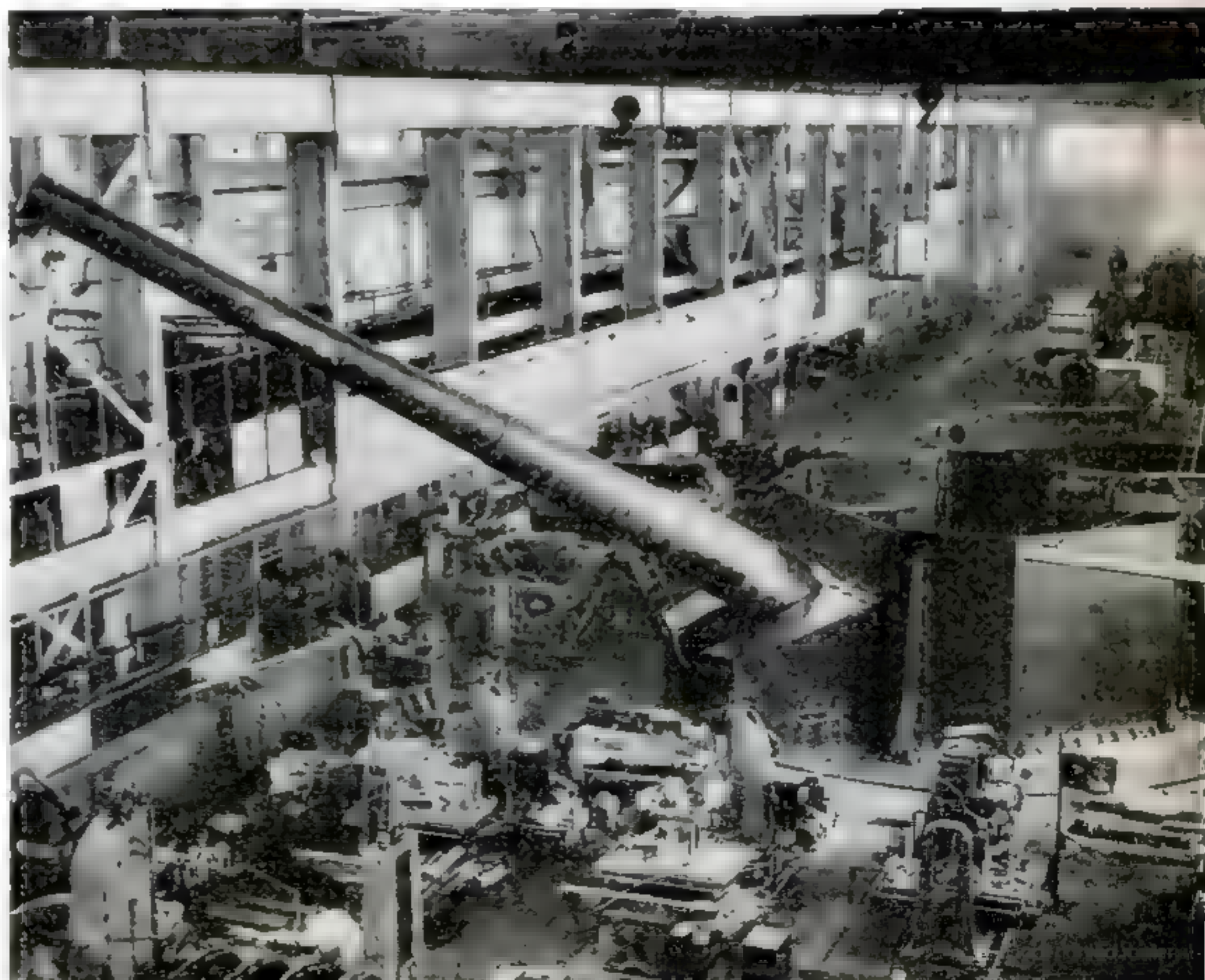
PUERTO RICO TO BE MADE "HAWAII OF THE CARIBBEAN," BY \$30,000,000 PROGRAM FOR FORTIFICATION WITH TROOPS AND PLANES



A "SHORT CUT TO ASIA" FOR AMERICAN NAVAL MANEUVERS

The string held across the globe shows the direct great-circle route that will be mapped for U.S. warships. Chart at left gives outline of defense program

Below is another "loudspeaker" for Uncle Sam: a huge sixteen-inch gun nearing completion in the arsenal at Watertown, Mass.

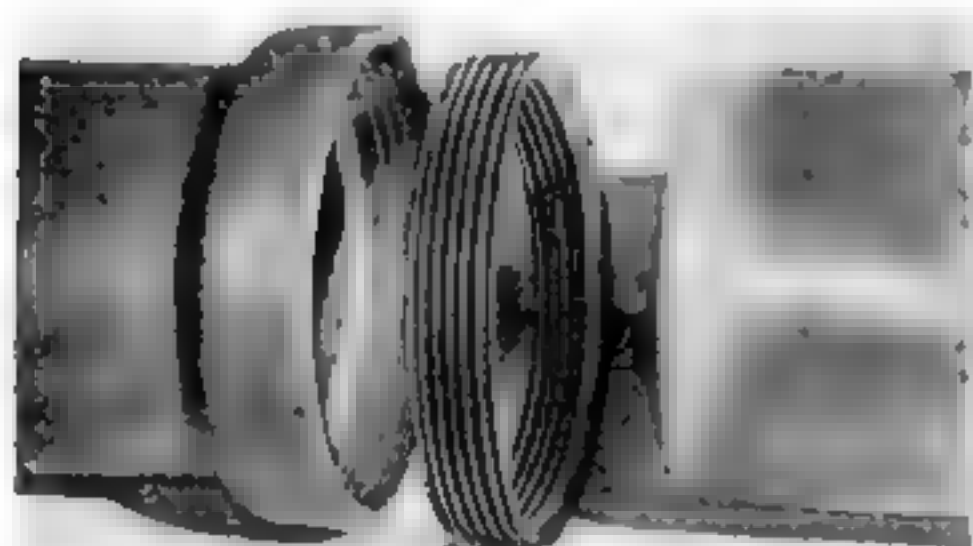




How a practical-minded Englishman combined his rock garden and bomb shelter

Rock Garden Screens Odd Bomb Shelter

GRACED by flowering plants, little animal figures, and a glistening fountain, a rock garden made by Oswald White, a dentist of Bedford, England, seldom fails to gain the admiration of passers-by, most of whom would be amazed to learn that this garden spot actually conceals an efficient bombproof air-raid shelter ten feet long, four feet wide, and with strong concrete walls a foot and a half thick.



Doctor Sets Bones with Wood Pegs

THE term "peg leg" takes on a new meaning with patients whom a Roumanian doctor treats for broken leg bones. Instead of putting metal or wooden splints on a leg, he whittles pegs out of hard wood and fastens them permanently inside the damaged bone, much as a carpenter repairs furniture.



Flexible Joints Protect Tile Pipe

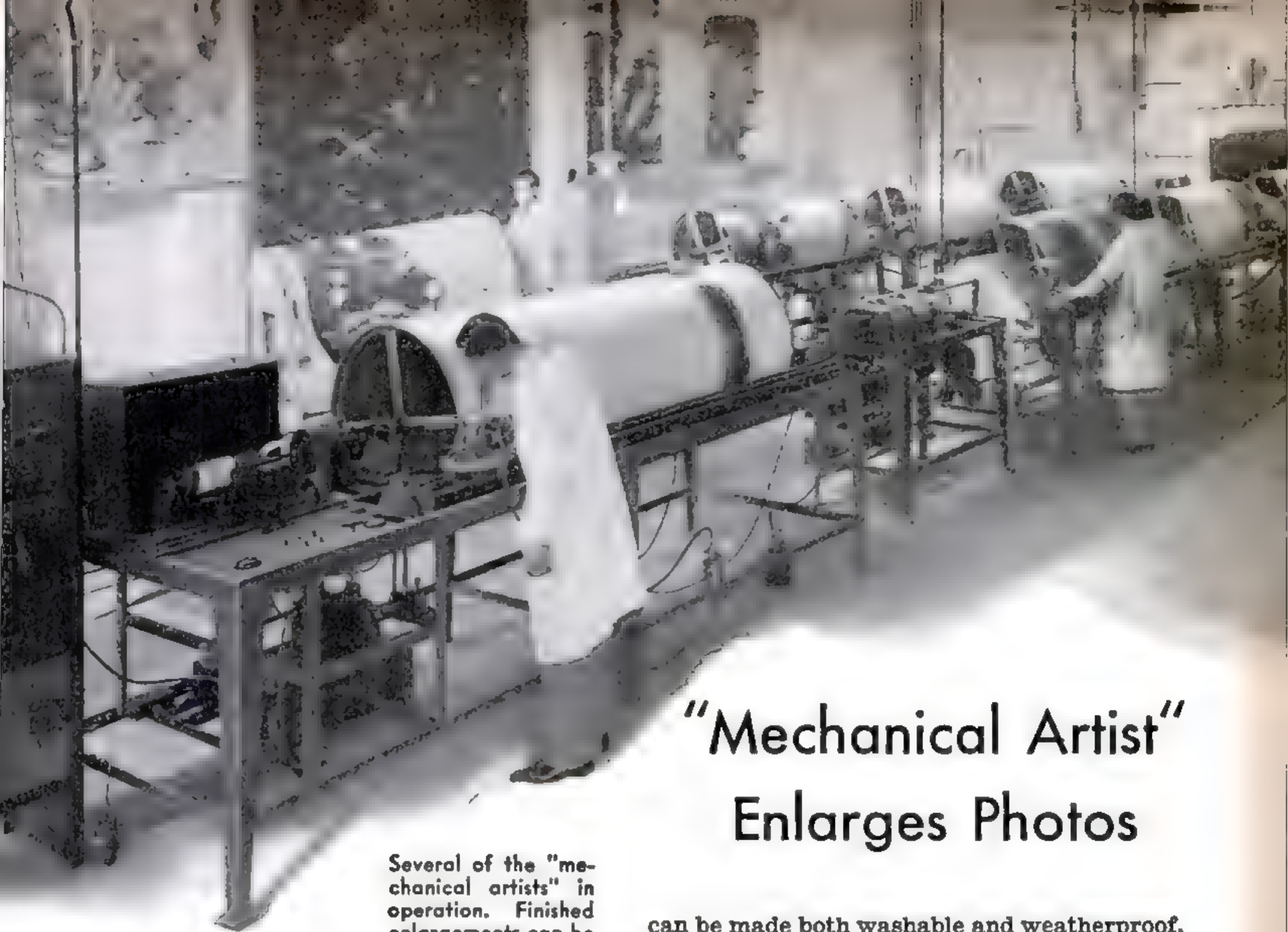
SELF-LOCKING rubber joints recently introduced are said to make tile pipes acidproof as well as waterproof, and to minimize the danger of breakage. Corrugated outside and inside, the joints act like suction cups to hold the tile-pipe sections together. Because the rubber joints are flexible, earth cave-ins and other unforeseen stresses are less likely to break the pipe line.

Rubber Exercise Mat for Home Use

SEALED in live rubber, millions of tiny air bubbles make a new exercise mat buoyant, resilient, and exceptionally comfortable for reducing or other exercises at home or in a gymnasium. The mat will not absorb perspiration, is washable, and can be rolled into a comparatively small and compact bundle for easy storage in a closet or locker.

This rubber exercising mat is designed for absolute comfort





"Mechanical Artist" Enlarges Photos

Several of the "mechanical artists" in operation. Finished enlargements can be seen hanging on wall

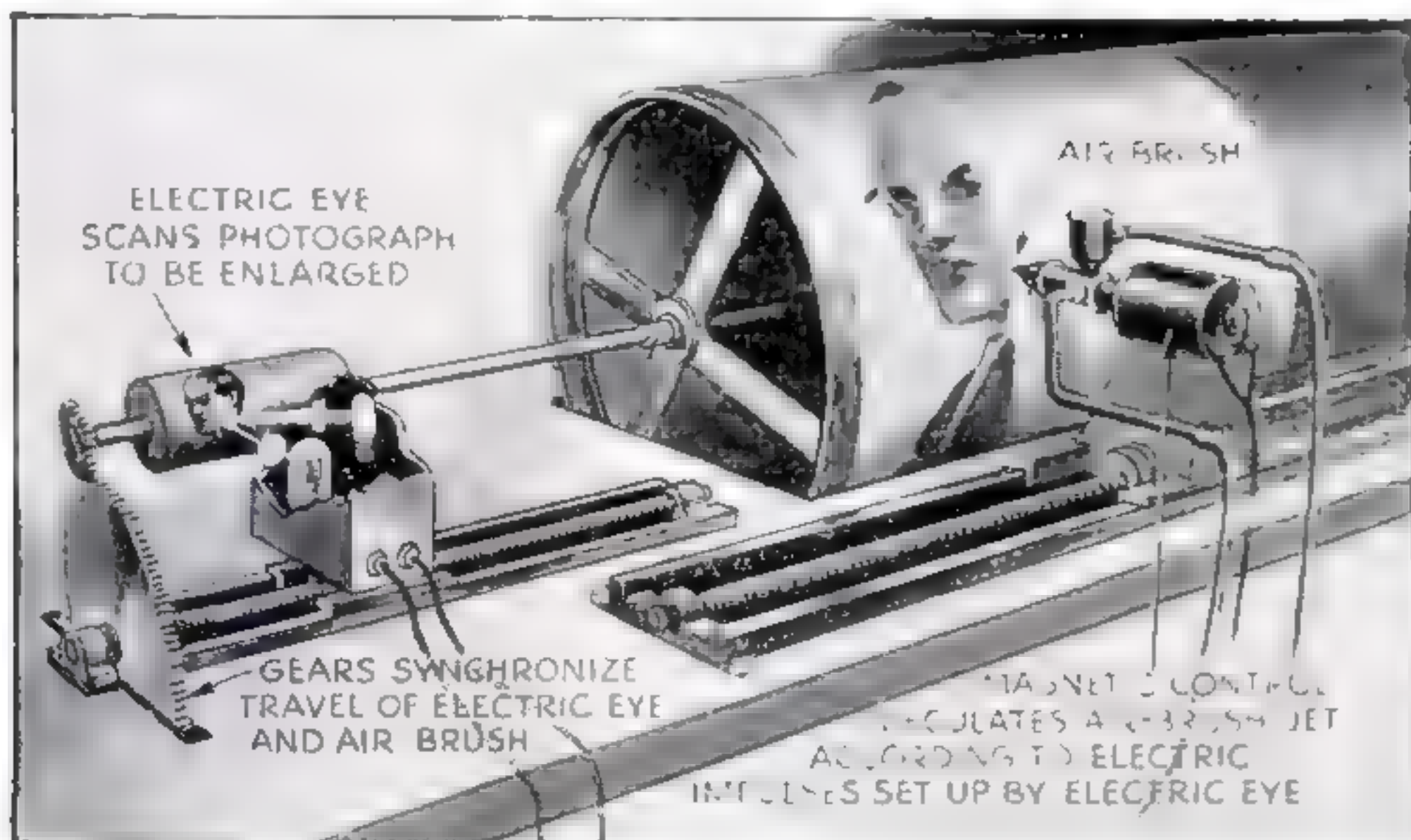
AUTOMATICALLY enlarging photographs to eight times their original dimensions, a giant British "mechanical artist" wields an air brush controlled by an electric eye to produce a painted instead of a photographic image. Strikingly effective photo murals for decoration and advertising result. They may be produced upon paper, linen, canvas, or thin sheets of metal, and

can be made both washable and weatherproof.

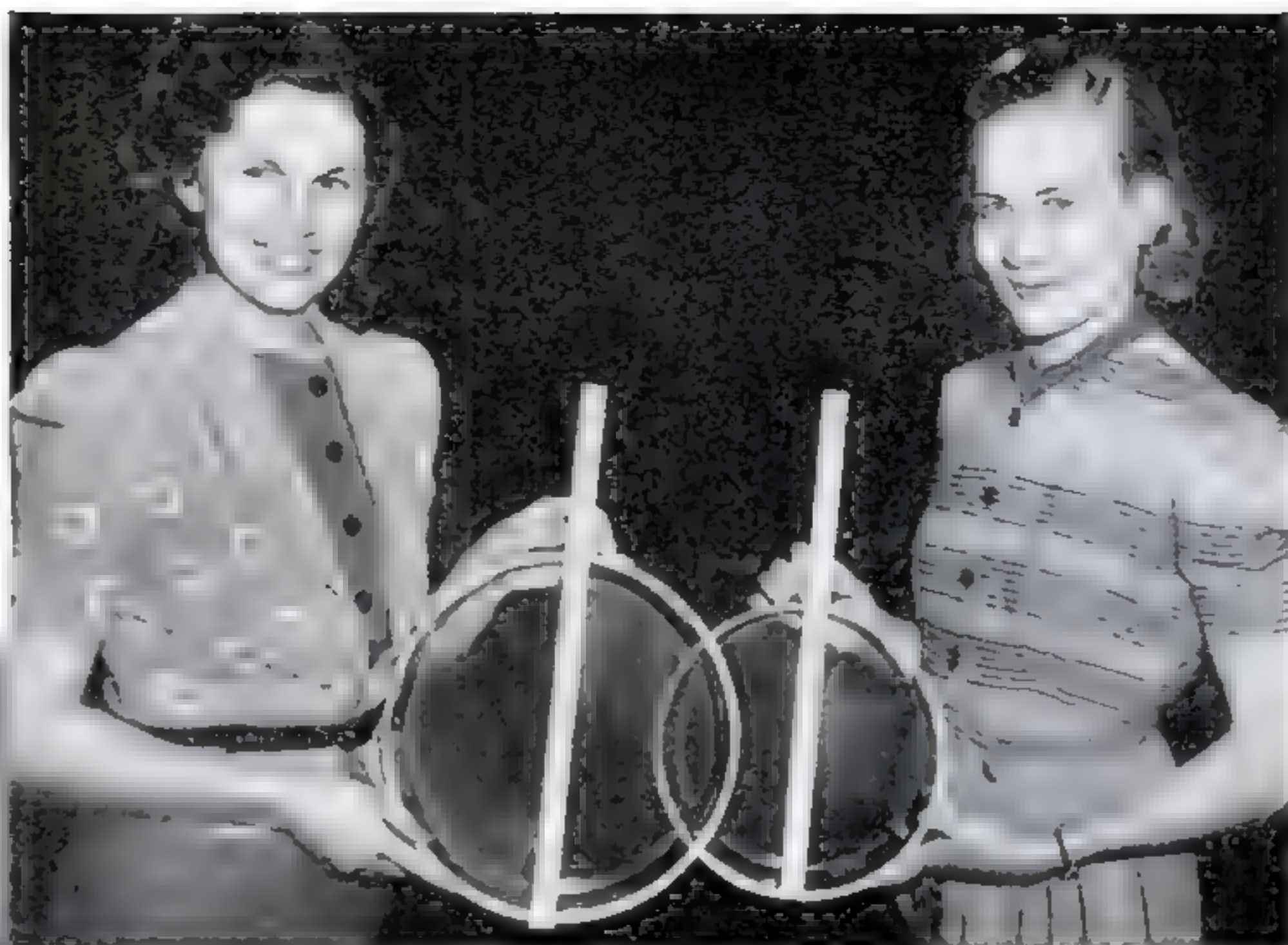
In principle, the "mechanical artist" operates much like the devices that transmit photos by wire. Placed on a revolving drum, the original photograph is scanned for light and shade by a photo-electric cell. At the "receiving" end, the impulses from the cell control the jet of ink from an air brush. The arm holding the air brush moves in step with the scanner, but on a magnified scale, across a giant drum holding the paper or fabric to be painted. The size of the original determines that of the finished picture. With a

seven by eleven-inch original, the largest size handled, an enlargement of fifty-six by eighty-eight inches is obtained. By piecing sections together, a painted enlargement thirty by thirty-four feet was recently produced.

Since the new process is not restricted to just black or sepia, enlargements may be turned out in any color. Full natural colors are obtainable by enlarging, in register, three photographic originals made with suitable filters. A black-and-white enlargement costs about half as much as by photographic methods.



An electric eye, scanning the original photo, controls the air-brush jet



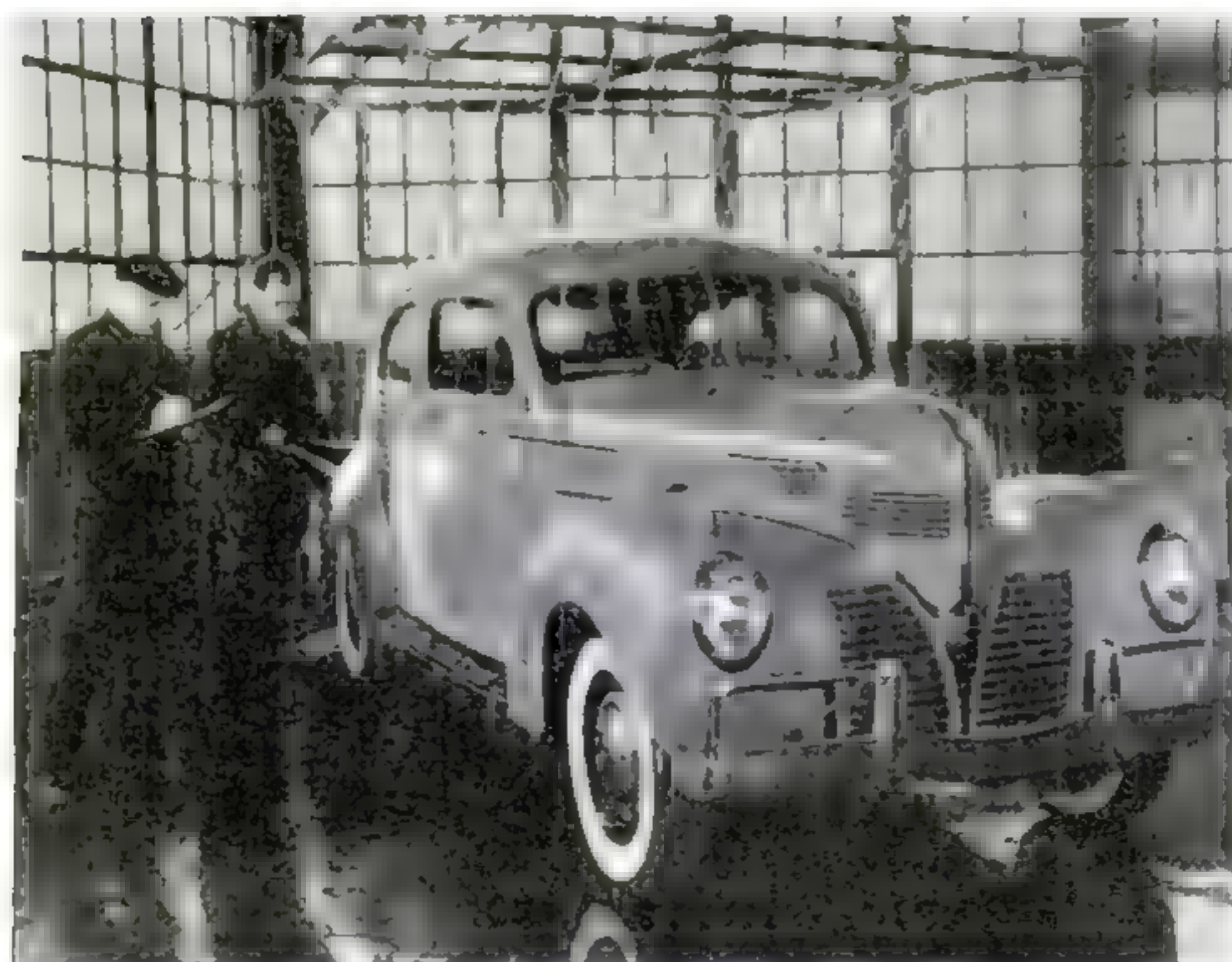
Glass dishes before and after the final heat treatment

New Heat-Resisting Glass Shrinks in Manufacture

GLASS which can be heated cherry-red and then plunged into ice water without breaking has been produced as the result of years of experiment by Corning Glass Works research workers. A final heat treatment shrinks glass objects to less than two thirds of their original volume with no distortion.

Pouring molten iron in the new glassware set on a cake of ice

Artificial Cloudburst Tests Car Bodies



A RAIN MAKER that creates an artificial downpour within a factory to drench the body of a completed automobile, is maintained by one car manufacturer to check the body structure for possible leaks or cracks where water could seep into the interior, or cause damage to the motor or other working parts. Water is piped to an overhead rack, where it streams out through tiny holes, as shown in the photograph at the left. Valves control the flow of water to produce either a gentle, steady shower, or a torrential cloudburst. Checkers go over the car after every test to make sure it is watertight.

Garden Cultivator Uses Electricity To Fertilize Soil

A NEW portable agricultural machine applies a high-tension electric current to the soil. According to Fred Opp, of Costa Mesa, Calif., the designer, the current increases the nitrogen content and stimulates bacteria growth in the soil and thus improves its fertility. A generator with an output of 110 volts A.C., a storage battery for exciting the armature field, and a transformer that steps up the current to 15,000 volts, are mounted on a walking-type garden tractor equipped with a small gasoline motor that drives both the tractor and the electric generator. Current is conducted through a pair of electrodes to furrows in the soil made by a cultivator. As the electrodes are dragged along, soil falls on top of them, making the contact.



Electric soil fertilizer in use. A gasoline engine propels the machine and generates current shot into the soil by electrodes

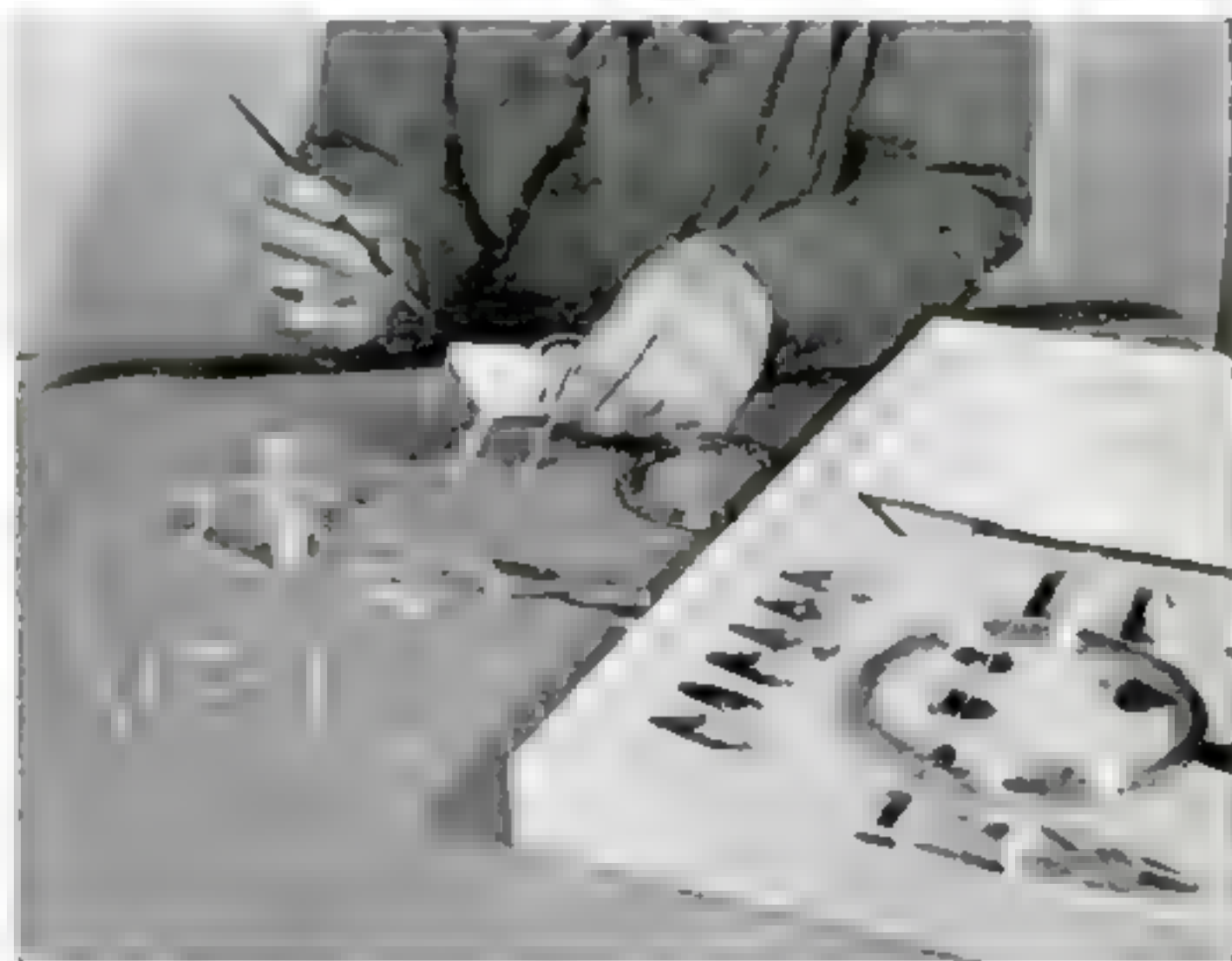


Pilot Equips His Plane with Rear-View Mirror

TO MAKE it easy for him to see whether any other airplanes are behind him while in flight or while taxiing across a landing field, a New York pilot recently equipped his plane with a small rear-view mirror. Securely riveted onto the metal "pants" around the plane's left landing wheel, the mirror is located in full view of the pilot in the cockpit, so that only a glance is necessary to indicate to him what other craft behind him are doing.

Wire Ornaments and Toys Made with Novel Kit

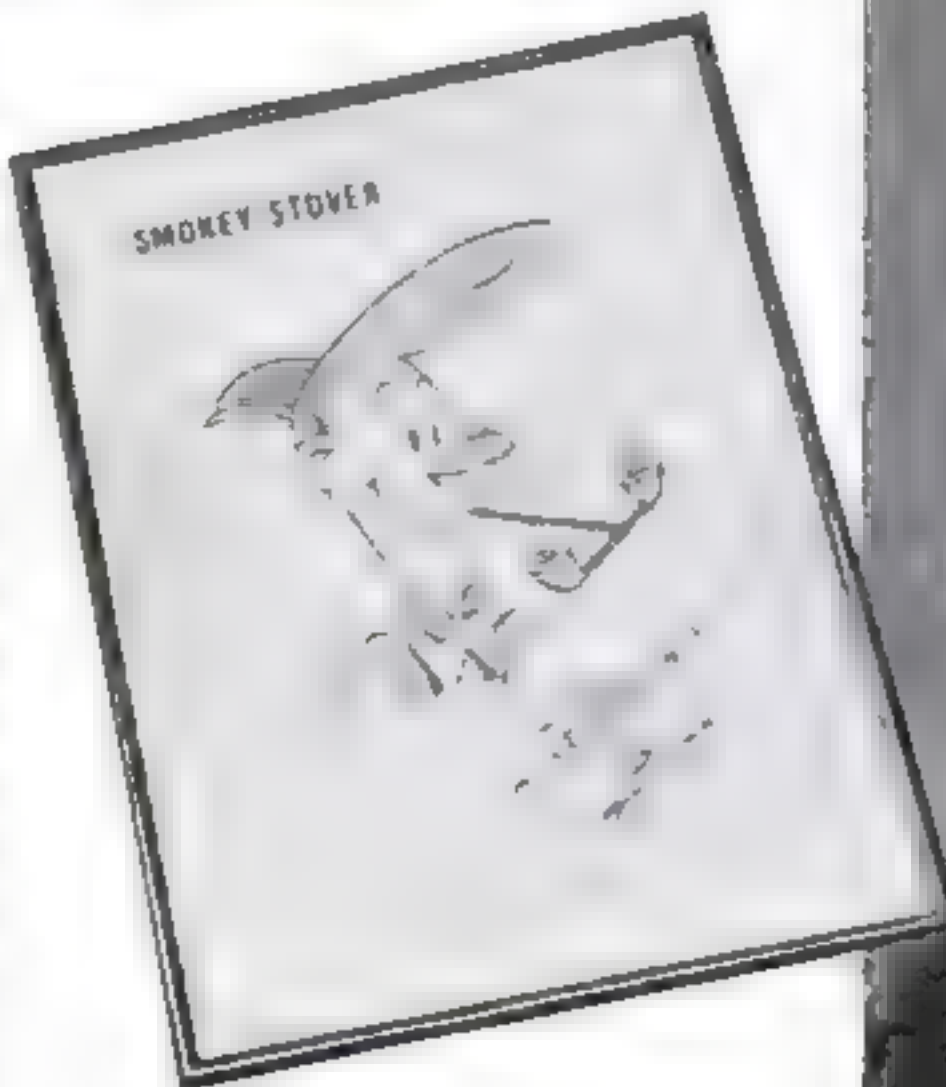
A KIT containing all the necessary tools and materials for fashioning decorative or toy objects from wire has recently been placed on the market. Two types are available—one for making simple, two-dimensional objects, and a more elaborate outfit for constructing doll furniture, bird cages, and other items. Pliers, wire cutters, coloring enamels, and coils of soft and hard wire, together with instructions and drawings are included in both outfits.



Making tiny objects of wire with the new kit, which includes pliers, cutters, enamel, and coils of wire

Double-Bowl, Single-Stem Pipe for Two-Fisted Smokers

FOR double-barreled smoking enjoyment, pipe lovers are invited by the proprietors of a New York City tobacco shop to try out their latest development, the twin-bowl, single-stem pipe pictured at the right. Something like burning his pipe at both ends, the smoker fills and lights both bowls, and draws smoke from each through a slender bit that taps the center of the pipe's double-ended stem. The idea for the novel tobacco furnace originated with the artist who draws the popular newspaper cartoon Smokey Stover.



This comic-strip character's pipe inspired the twin-stack novelty for smokers at right



Compact Copying Machine Is Portable

A PORTABLE photographic copying machine recently introduced is so completely contained within its own cabinet that even its developing chemicals do not have to be drained off while the unit is in transit. Simple to operate, the apparatus has an adjustable focus,

a cartridge containing 200 feet of sensitized paper, a severing device for cutting paper to a desired size, built-in lights, and an automatic developer into which the exposed, sensitized paper is fed. It employs an automatic timing mechanism synchronized with its lights so that the latter are turned off the instant that the proper exposure of an original has been made. The front of the apparatus drops down to form a copy holder that can be adjusted vertically as required.



All equipment needed for copying maps, letters, and documents directly on sensitized paper is contained in the portable unit shown in use above



Hobbyist Studies Secrets of Fishing Flies

DID YOU EVER WONDER WHAT A FISH SEES IN AN ARTIFICIAL LURE? THIS MAN SPENT FIFTEEN YEARS TO LEARN

By ROBERT E. MARTIN



Royal Coachman fly compared with Jennings's sketch of a real insect

WORKING long evenings in his dining-room workshop, Preston J. Jennings, Brooklyn, N. Y., sales engineer, has spent his spare time for the last fifteen years probing the secrets of the artificial fishing fly. Why do some flies seem to catch more fish than others? How do fish see and comprehend these lures? What is the relationship between many of the fantastic creations of fur and silk and feathers, and the natural insects upon which the fish often feed?

To test his theories developed during this home research, Jennings has spent his summer vacations fishing the best trout streams of North America—from Pennsylvania to Nova Scotia, and through the whole length of the American and Canadian Rockies.



Preston J. Jennings with part of his collection of artificial flies

The result of his investigation is a better understanding of the whole complex subject of fly-fishing—taking into account not only flies and fish, but some of the pet traditions and superstitions of the angler at the other end of the line.

Among fly-fishers there have always been two schools of reasoning. One school, long established in Great Britain, holds that trout have a considerable measure of intelligence, and that they nip at various artificial flies cast before them, because they mistake the flies

for real insects with which they are familiar. The other school, popular in America, is just as ready to swear that the most "killing" flies bear practically no resemblance to any living creature on land or sea, but are merely tricky, seductive, man-created lures.

Jennings leaned decidedly toward the first school, especially as concerned dry-fly fishing. Most anglers would have stuck to their opinion and let it go at that. Jennings determined to try to settle the matter by practical research. He began by collecting artificial flies—hundreds of them. Every different fly he saw or heard of he bought or tied, and carefully filed for reference. The newest creation of some modern Ike Walton soon rubbed hackles with a Green Drake and a Gray Drake tied by James Ogden, the Englishman who tied the first dry flies ever used, nearly a hundred years ago. Before long, the dry-fly branch of his collection became probably the largest collection of its kind in the world.

His purpose was to try to establish the identity of the best of these flies with natural insects. No angling writer in this country had ever attempted it before. Before he could begin he had to tackle personally the tremendous job of identifying, studying, and cataloguing all the stream insects of North America!

Thenceforth, his fishing trips became also scientific insect-hunting expeditions. Armed with magnifying glass and specimen bottles, he spent the minutes between bites collecting samples of stream flies. A dozen angler friends soon began helping in this insect survey. To date, Jennings and his friends have collected more than 3,000 specimens, comprising all the stream insects of eastern North America, and most of those from the West.

Careful study of these insects, and equally careful study of his vast collection of artificial flies, has led Preston Jennings to a



The hobbyist at his fly-tying desk, surrounded by rare-bird feathers



A baby blue-dun English game cock. Jennings has his own flock to supply blue-dun hackle feathers

number of interesting discoveries and conclusions. One discovery is this: Handed down by tradition, and tied originally in this country by fly tyers from Great Britain, most so-called "American" artificial flies are really

patterned after specific insects that frequent British trout streams. And the reason they often cannot be matched exactly with American insects is that not a single species of British aquatic insect can be found in all the insect specimens taken from American waters!

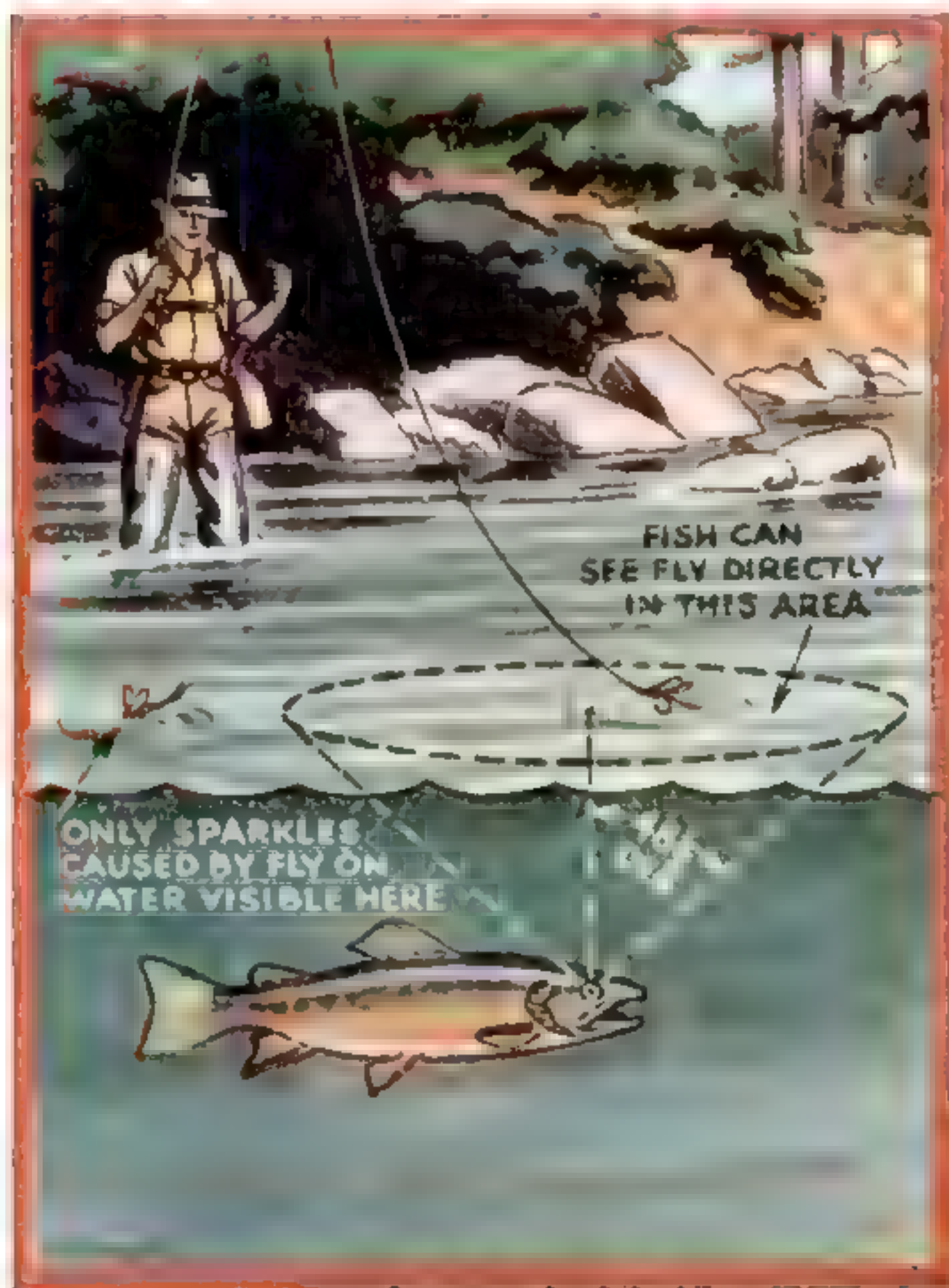
He discovered also that, although not generally known to American anglers, a number of the best genuine American flies were deliberately patterned after real insects. The popular dry fly Hendrickson, for instance, was designed to imitate the female of a widely distributed May fly, *Ephemerella invaria*.

On the other hand, many dry flies that had been considered previously to be purely fantastic creations were found to have definite

resemblance to natural insects. The Fan-Wing Royal Coachman had always been regarded as one of the most fetching of these absurdities, and the incredulous among Jennings's friends challenged him to find its counterpart in nature. For twelve or thirteen years he sought in vain. Only two years ago he discovered what he considered its natural duplicate: the *Isonychia bicolor*, an extraordinary May fly, yet one of the most plentiful.

Must the hundreds of flies patterned after British stream insects be redesigned to check with the species in American streams? In many cases it is unnecessary. In giving this answer, Jennings tries to appraise the flies from the trout's, rather than from the angler's point of view. The angler sees a fly by reflected light against a dark background of water; the trout sees the same fly almost as a two-dimensional silhouette against a light sky. Many flies which look completely dissimilar to any insects in nature, may look like natural insects to the fish.

Then again, a fish sees out of the water into the air above through a limited circle of view, often referred to as the fish's "window." This circle is caused by the refraction of light waves entering the water, and limits his vision to an angle of forty-eight and a half degrees from the perpendicular. Beyond the edges of his window, the surface of the water acts as a solid mirror, reflecting the bottom of the stream. This mirror is also important to fly-fishing, as flies alighting on the water make tiny indentations which act as lenses. These cause little sparkles under the water, flashing light before a trout's eyes like fireflies across a dark sky. Thus a trout gets his first knowledge of a fly on the surface of the water before he can see it directly.



A fish sees into the air through a narrow "window," or limited circle of view, as above

How do these fantastic lures attract fish? That is the problem Jennings has been studying for years



Hurricane House

WEATHER-VANE DWELLING DESIGNED FOR



Rotating on triple circular tracks, this unusual house turns itself to point its rounded end into the wind, defying even gales of hurricane force. In ordinary weather, it can be made to face in the best direction with reference to sun and breeze

By **CARL WARDEN**

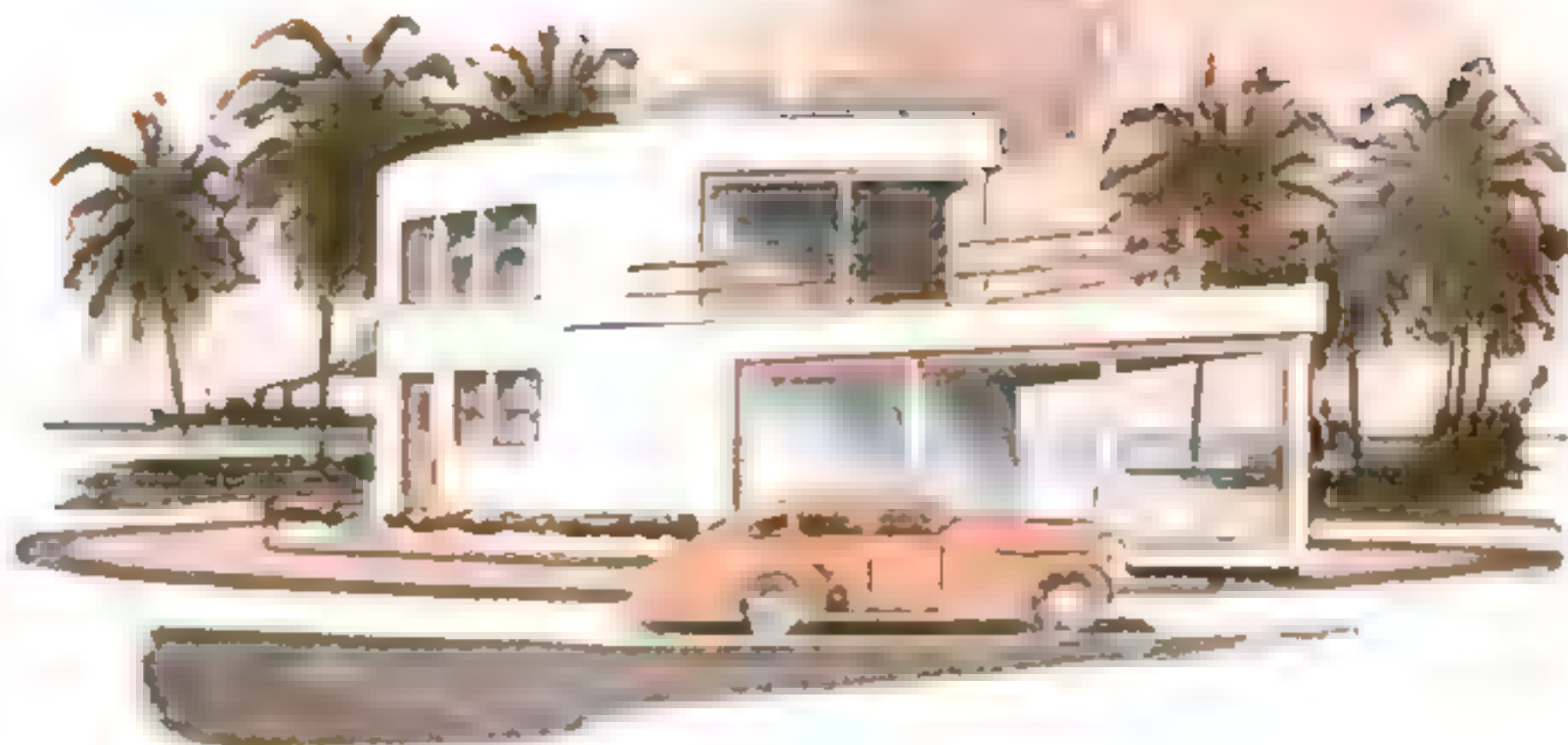


Turns with Wind

BOTH SAFETY AND COMFORT

WHEN raging storms whip across the land, accompanied by violent gales that uproot trees, tear the roofs from houses, and turn a trim countryside into a scene of desolation, there could probably be no safer refuge than the interior of a novel hurricane house designed by Edwin A. Koch, New York City architect. Streamline in the form of a mammoth tear-drop, this amazing dwelling would revolve automatically to face into the oncoming storm, meeting it like the wing of an airplane and passing it smoothly around its curving sides toward its pointed tip.

Although planned for areas subject to periodic winds of gale force, the unique home has other unusual features that adapt it to luxurious living in any climate. Constructed of light steel channels and I-beam sections

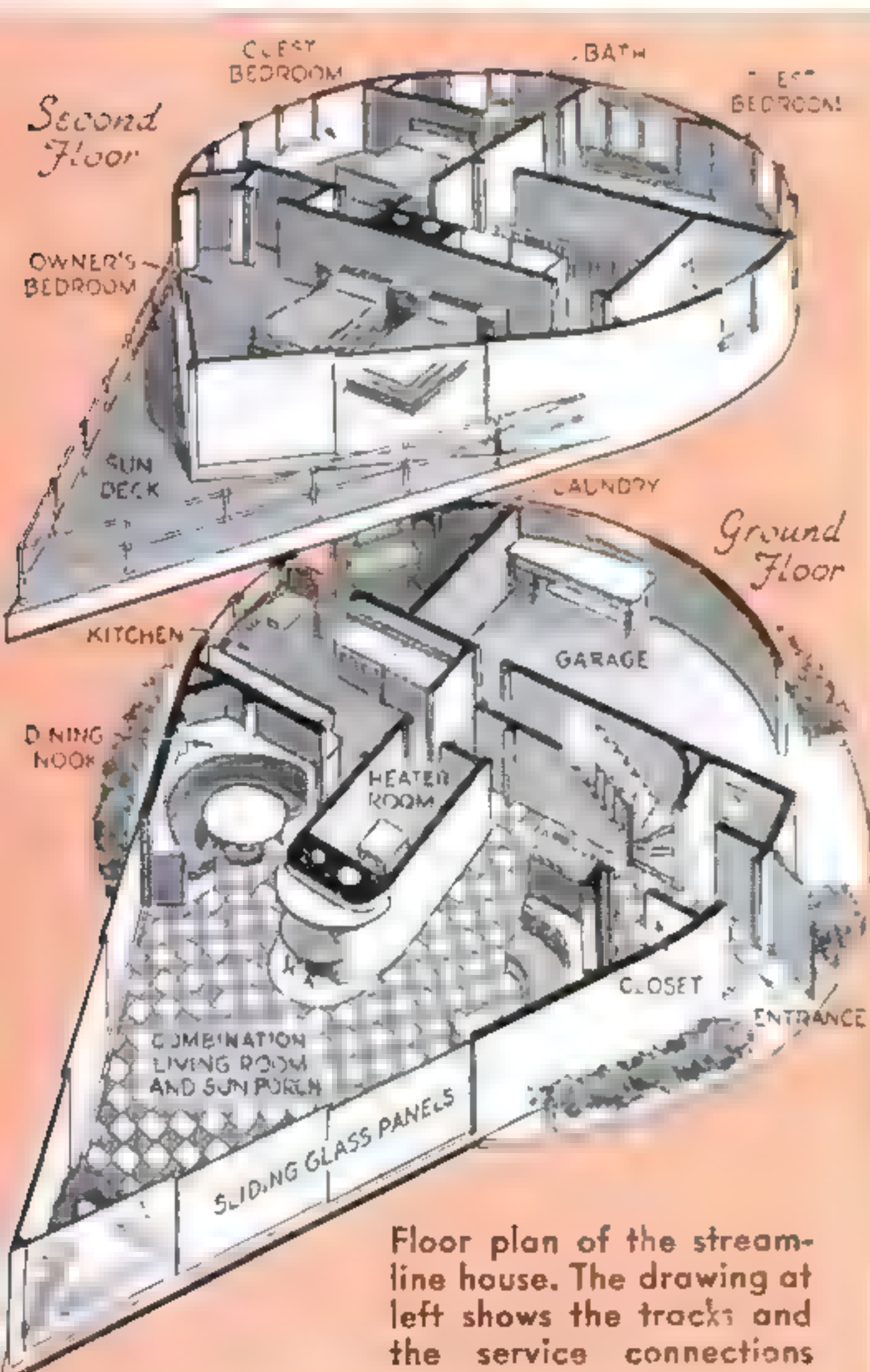


bolted together, the house has insulated walls faced on the exterior with semiflexible waterproof plywood. The entire structure rests on flanged wheels similar in construction to those found on a highway or railroad drawbridge. These run on three separate circular tracks: an inner track twelve feet in diameter, a second, placed just below the exterior walls, measuring thirty-one feet in diameter, and an outside, sixty-eight foot track for a wheel located at the pointed tip of the dwelling and cleverly concealed by an indoor living-room flower-bed.

A cantilevered floor covered with boiler plate extends beyond the outside walls for a distance of four feet to prevent driving rains from beating into the pit below the house, and to form an apron for the garage, a platform for the entrance doorways, and a ledge for flower boxes. Electricity enters the building through the inner track, while the water-supply and sewage pipes come in underground at the axis on which the house turns, swivel joints being provided to connect the stationary exterior pipes with those which are attached to the dwelling.

Inside the house, the first floor provides an entrance hall, a triangular living room with a built-in dining section on one side and a built-in library nook on the other, a kitchen, laundry, heater room, and a garage having space for a workbench and a trapdoor that provides access to the piping, wiring, and track mechanisms in the foundation pit below. Upstairs there are three large bedrooms, two baths, and a spacious open sun deck. Garage doors, and most of the broad expanse of glass windows, slide into the walls.

Merely by selecting the desired push button on a central control board, the entire house may be rotated to face rooms toward or away from the sun or to point bedroom windows toward a cooling breeze.



Floor plan of the streamline house. The drawing at left shows the tracks and the service connections

Bacteria Farm Is "Garden of Death"



Racks of test tubes in this refrigerator hold billions of microbes for scientific researchers. Bacteria live on jelly in the bottom of each tube



DEADLY germs that could cause bubonic plague, tuberculosis, typhoid fever, or any one of a host of other human scourges are available at reasonable prices from a strange test-tube garden of death maintained by experts at the Georgetown University Medical School in Washington, D.C. Estab-

lished for the benefit of physicians and other qualified scientists for research or diagnostic studies, the germ farm can furnish some 2,700 species and strains of bacteria, fungi, yeasts, and other microorganisms.



Made of aluminum with raised, painted letters, the sign on the tree is durable

Permanent Game-Refuge Signs

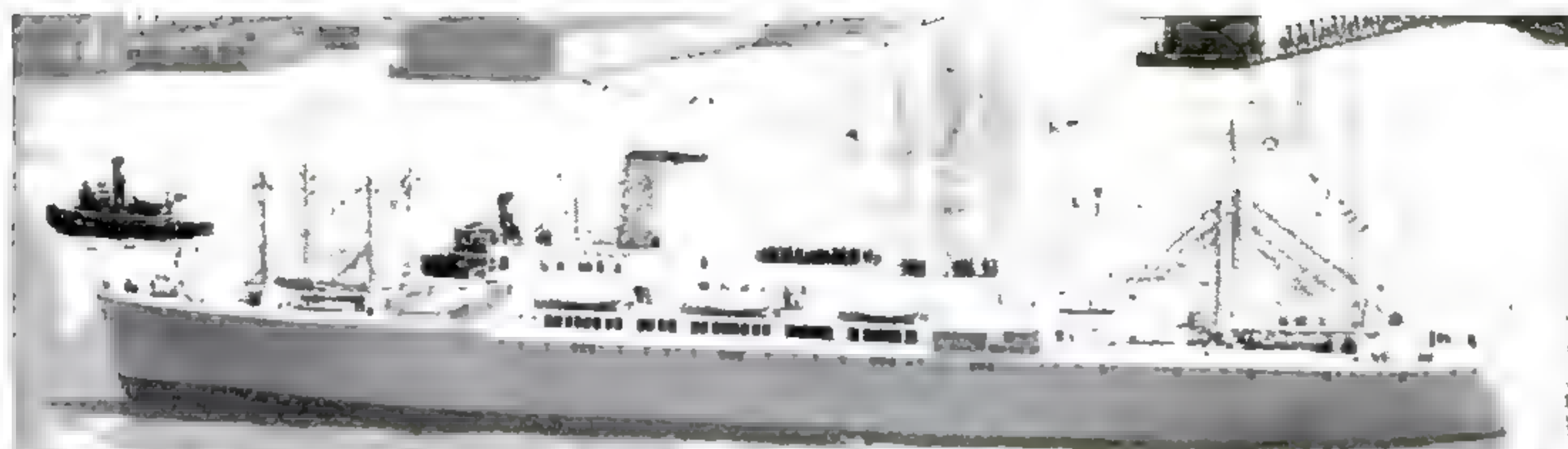
ALL-WEATHER tags of shiny sheet aluminum are now being used by New Jersey conservation officials to replace the less durable, printed fabric signs formerly used to mark the borders of state game refuges. Raised lettering, bright red in color, makes the warning messages legible, and practically permanent.

Electric Trap Kills Rodents

MICE looking for a bite to eat get the shock of their lives when they investigate the cheese titbit placed in an electric mouse-trap recently invented. Resembling a deep electrical socket, the hot seat for rodents is connected to an electric outlet, and electrocutes an inquiring mouse the instant it bites into the bait.



When a mouse nibbles bait in the trap, it is quickly electrocuted



Fireproof Liner Uses Home-Type Wall Insulation

INSULATION of the type extensively used in modern home construction has recently been adopted by naval architects to give added safety and comfort to passengers on ocean liners. Outside walls and ceilings of all staterooms are packed several inches thick with mineral wool, a fluffy, fibrous, fire-resistant material made from spun minerals and having high insulation properties against heat and cold. One of the first ships to be completely insulated is the new S.S. *Panama*, which has been called the safest liner in the world. Said to be non-



Installing heat, cold, and fireproof insulation on cabin walls of the new liner "*Panama*," shown at top approaching her New York City pier

sinkable, the *Panama* is the first entirely fireproof vessel to be constructed according to the latest specifications of the U. S. Bureau of Marine Inspection and Navigation.



Marcus Le Touche coaxes his pooch into a gas-attack shelter he built

Gas-Raid Shelter Protects Pet Dogs

AIR-RAID protection, a peacetime program familiarly known as A.R.P. to every English citizen and designed to prepare for the safety of men, women, and children in case of wartime bombing or gas attacks, is now being extended to include animal pets. Recently, Marcus Le Touche, a dog owner of Charlton, Middlesex, developed a gasproof, portable dog house in which his pup would be entirely safe from poisonous fumes. The dog is pictured being urged to try out the new kennel.

Streamlining the

"FLASH: Eight convicts escaped early this morning from Trieve prison farm at Angleton."

At Austin headquarters of the Texas Rangers, an officer read the dispatch as it came from the teletype. Scarcely a minute elapsed before others were asking the prison for details, searching the Bureau of Identification for pictures among the 160,000 on file, telephoning rangers, sheriffs, and state police to blockade all roads.

Within an hour, 100 officers were patrolling the area around Angleton, and later that day six of the armed desperadoes fell before the blazing guns of veteran man hunters; and the remaining pair, fearing the rangers' deadly fire, gave themselves up.

This speedy, concentrated, highly organized work offers a modern contrast to the rangers' operations of only a few years ago.

Then, in hunting down and capturing cattle thieves, border smugglers, thieves, and murderers, they relied on six-guns and on horses which could cover only a few miles a day. Now they speed into sparsely settled sections in automobiles, their mounts riding behind them in trailers; carry fingerprint and mou-lage outfits, submachine guns and tear-gas weapons. Backing them up in the Austin laboratories, a corps of scientists investigates every bit of evidence.

By such means the small force of thirty-two men, consisting of six captains, one sergeant, and twenty-five wind-bronzed privates, keep the peace in the Lone Star State. They rely upon science to support them in court, but their reputation for law enforcement is founded on personal bravery, evidenced many times since 1826, when Stephen F. Austin organized the first mounted ranger company of twenty men to beat back Indian bands then harassing

By
**ANDREW R.
BOONE**

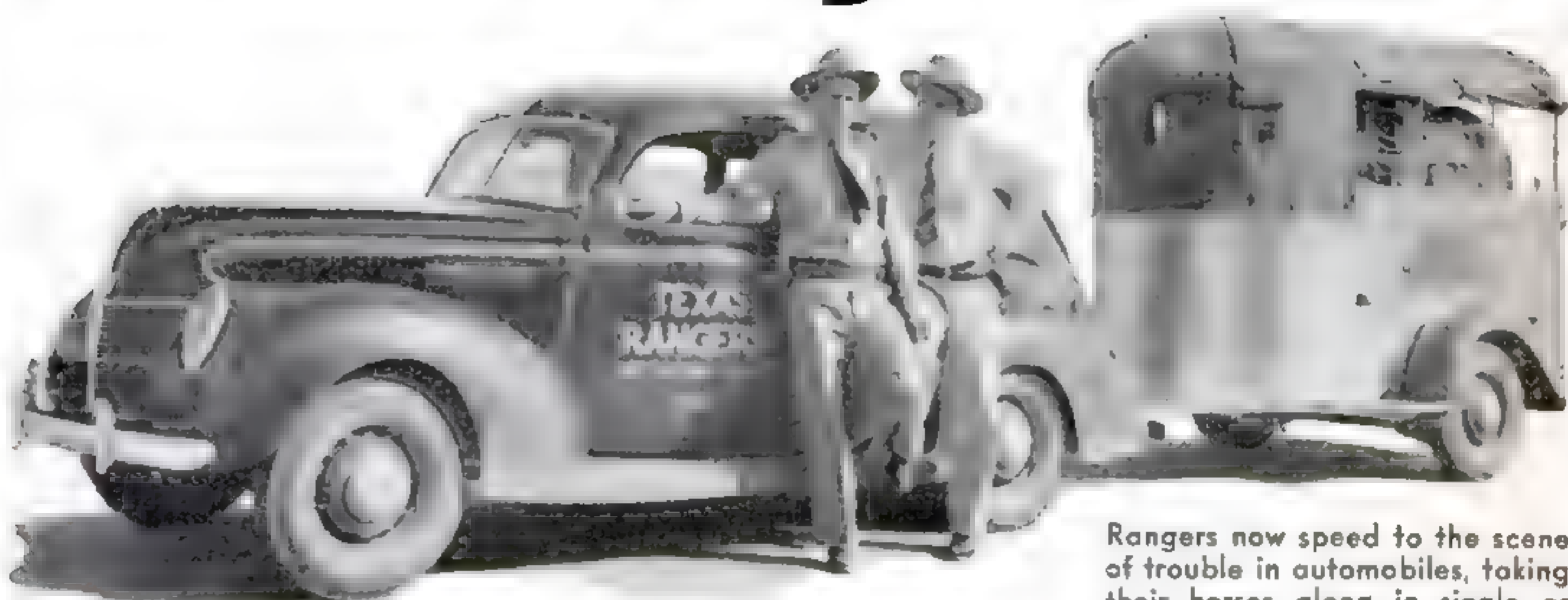


HOW THIRTY-TWO MEN PATROL AN EMPIRE

All Texas is divided into five ranger districts, each policed by a captain and five men. Some of these districts are larger than whole states. At the right, receiving reports by teletype



Texas Rangers



Rangers now speed to the scene of trouble in automobiles, taking their horses along in single or double trailers like that above

scattered white settlers along the Rio Grande.

The story is told, for example, of the ranger who answered a call for help in a riot-ridden town. "Where are the rest of you?" anxiously demanded a local citizen when he arrived. The ranger replied quietly, "There's only one riot, ain't there?"

Their reputation for quick drawing and straight shooting is well deserved, and every few weeks the rangers return to Austin where they train periodically on a novel target range to make sure they are not losing their gun eye. I visited that range, hidden in the brush at Camp Mabry, a military reservation, to learn for the readers of *POPULAR SCIENCE MONTHLY* how the members of this famous law-enforcement band keep themselves fit to match bullets with the most desperate outlaws.

As I arrived, I saw an automobile bearing two armed men flash across the field at high speed. In the foreground a ranger pumped lead into the car. On closer inspection, I discovered the car to be a life-size photograph, which rode on a taut cable through the brush. Another cable, attached to a drum mounted on an automobile, pulled the remarkable target back and forth at fifty miles an hour.

"Pretty fast action," I commented to S. O. Hamm, the rangers' commander. He smiled and then said, "have a look at this chase." At that moment, two automobiles hove into view, one being the big picture and the other a real passenger car. Standing in the front right window of the latter a ranger sprayed



S. O. Hamm, commander of the rangers. The horse is still the stand-by in the wild country



RANGERS ARE DEAD SHOTS —AND DETECTIVES, TOO

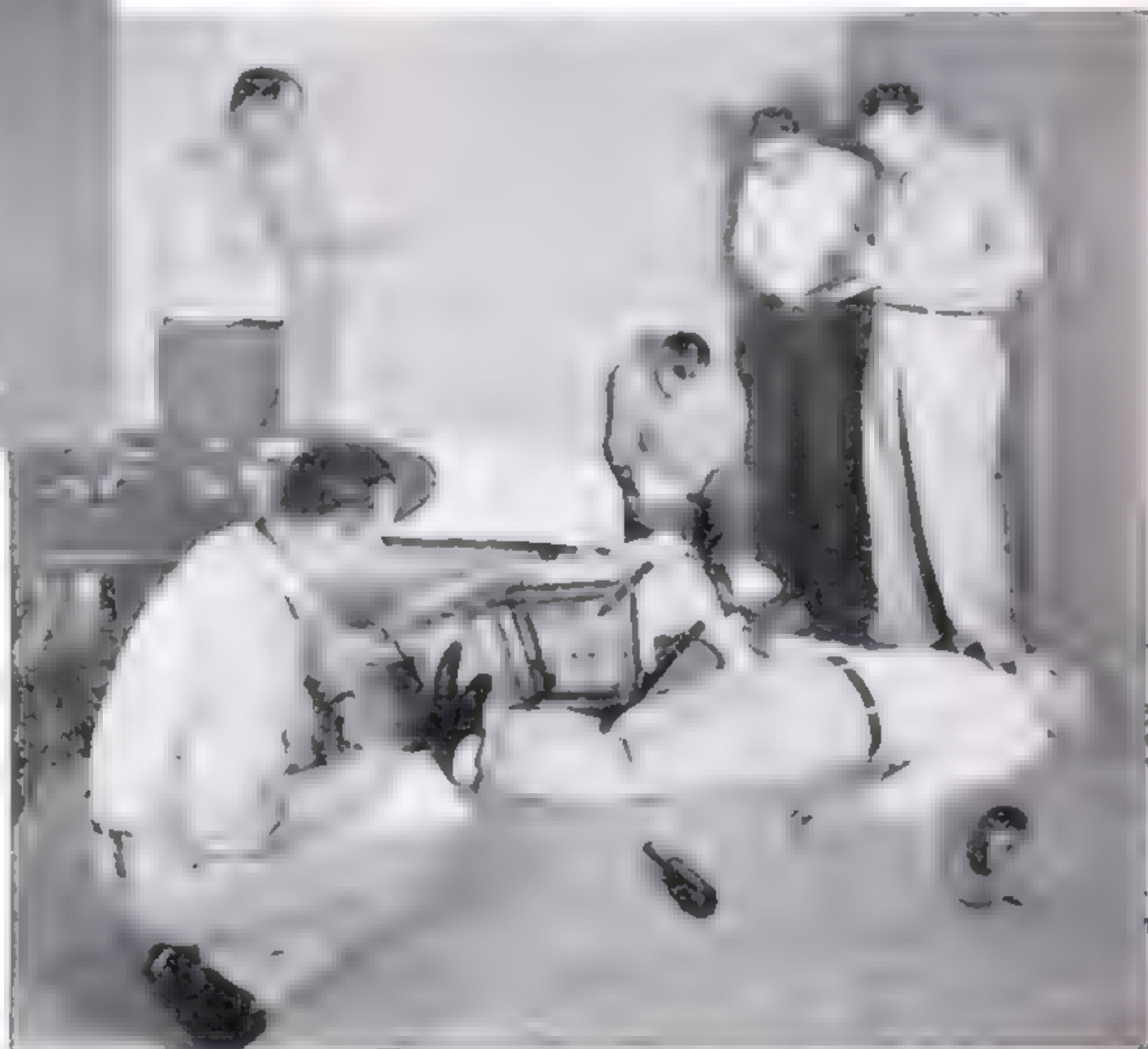
Recruits practicing pistol shooting. A steadying device is used at first to overcome nervousness. At right, a class studies a "crime," learning how to discover and analyze clues

the picture with bullets from a submachine gun. I examined the picture. Eleven hits, including perforations in the images of both gunmen!

A moment later, a chicken thief came running through the brush. Not a live figure, of course, but again a true-to-life picture which slipped across the field at the speed of a man fleeing the law. Bullets punctured both man and sack.

"Seems fairly easy to hit these marks," I commented. Commander Hamm smiled and pointed off toward the right. "There's the real test," he said.

We walked a short distance, and soon came upon a party of four men, one a ranger walking with raised pistol, the others a signalman and two judges. At intervals as they walked, the signalman raised a hand. In the distance, now perhaps forty feet ahead and again as far as a city block away, now on the left and next on the right, images of human figures popped up in the



Wild West, new style: a ranger firing a sub-machine gun at a moving target from the door of a speeding car

grass. At one figure, the ranger fired; at the next, he withheld his fire.

"These targets represent both outlaws and officers who are taking part in a search," Hamm explained. "When the signalman raises a hand, the operator pulls a lever to move the target. If the ranger shoots at an officer, he loses five points; when he hits an officer, he drops twenty points. But if he gets a criminal, he wins ten points. You see," he smiled, "we consider officers twice as valuable as criminals, even though in a negative sort of way."

While the rangers' early training centers on accurate shooting, commencing with indoor firing by means of wooden standards which help overcome nervousness, they quickly become skilled in developing latent fingerprints by means of powder blown on surfaces from atomizers; accustom themselves to the unpleasant fumes of gas; reconstruct crimes, and study clues which only skilled observers can detect.

Not long ago, a ranger was called to Pecan Gap, where

Rangers sometimes ride with the Coast Guard to run down smugglers on the Mexican border



PHOTOGRAPHS FOR TARGETS

Yanked across the target range below at fifty miles an hour, this "bandit car" teaches fast shooting. Right, a dummy chicken thief riddled with rangers' bullets





GUN FIGHTERS GO SCIENTIFIC

The gun room at headquarters. Firearms of many kinds are stored here to help in identifying weapons used in crimes. Below, matching a murder bullet with one fired from a suspect's gun, by means of a comparison microscope



a thief had stolen eighty-five dollars. Apparently the culprit had worn gloves, for no fingerprints were found; but the intruder had bitten into a slice of cheese, returning the piece to the ice box. Finding this, the investigator carefully wrapped the cheese, and at Austin a cast was made showing the burglar to have a peculiar, protruding front tooth. When confronted with the cast later, a suspect admitted, "you've got enough to hang me," and pleaded guilty.

Again, a murder at Thornton. Only evidence discovered was two empty shells from a twenty-gauge shotgun. Ranger C. G. Rush

carried them to headquarters, where measurements revealed that one cap was indented at dead center, the other near the edge. "This indicated either two single-barrel guns, or one double-barrel weapon," Rush deduced. Back to Thornton he went, where he picked up all the guns of that caliber; in the laboratory other shells were fired until a pair was produced whose indentations matched those found earlier. The death weapon led officers to a hotel porter who, confronted by the marks, confessed and was electrocuted.

By means of Coast Guard planes and their own fast cars towing trailers for their horses, the rangers can concentrate half of their force almost anywhere trouble is brewing within a day. To meet every emergency, they are equipped with the best of automatic rifles and machine guns, and when they set out on a man-hunt, these mobile rangers carry with them all the latest instruments of crime detection. Directed by radio, they maneuver through sparsely inhabited ranches, ready to close in and fight to the death with outlaws who try to outwit these hardy gun fighters.



Modern crime-detection methods help the rangers get their man. Here a technician makes a paraffin test for powder burns



Gilbert Wright demonstrates his invention which actually makes a saw "speak"

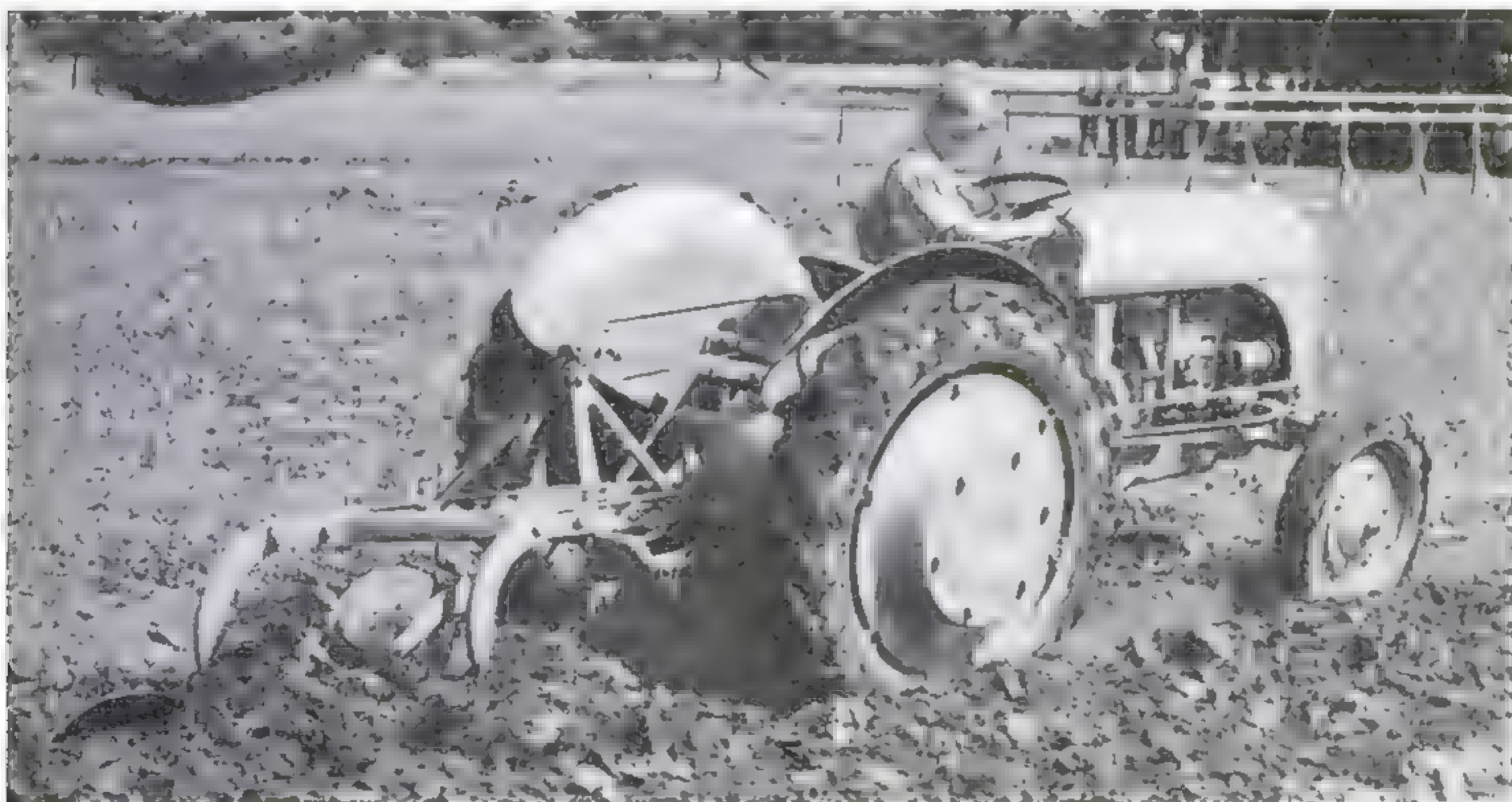
This Invention Enables You To Talk Like a Cow

THE rasping of a saw, the mooing of a cow, and various other sounds can be carried to the human vocal cords and transformed into words by means of an invention devised by Gilbert Wright, of Los Angeles, Calif. Sound of the human voice originates in the vocal cords and is formed into words by the mouth. Through Wright's device, sounds are picked up electrically and transferred to the vocal cords by means of vibrating buzzers. All the subject receiving the vibrations has to do is to form the sounds, artificially fed into the throat, into words.

Farmers Get New Low-Cost Tractor

SO LIGHT and easily operated that an eight-year-old boy can guide the machine across a field with a double plow operating behind, a new farm tractor was recently demonstrated

at Detroit, Mich. Its light weight increases the economy of operation of the new machine while a system of hydraulic controls facilitates handling plows and other attachments.



Even an eight-year-old child can drive this lightweight tractor and work its hydraulic plow controls



Map on Rain Cape Is Walking Atlas

A COLORFUL map of the United States, complete with rivers, mountains, boundary lines, and other geographical features, adorns a novel rain cape recently introduced. Made in either red or blue, the cape is fitted with a hood, and has extra large armholes to permit it to be worn over a regular coat.

Portable Cleaner for Spark Plugs

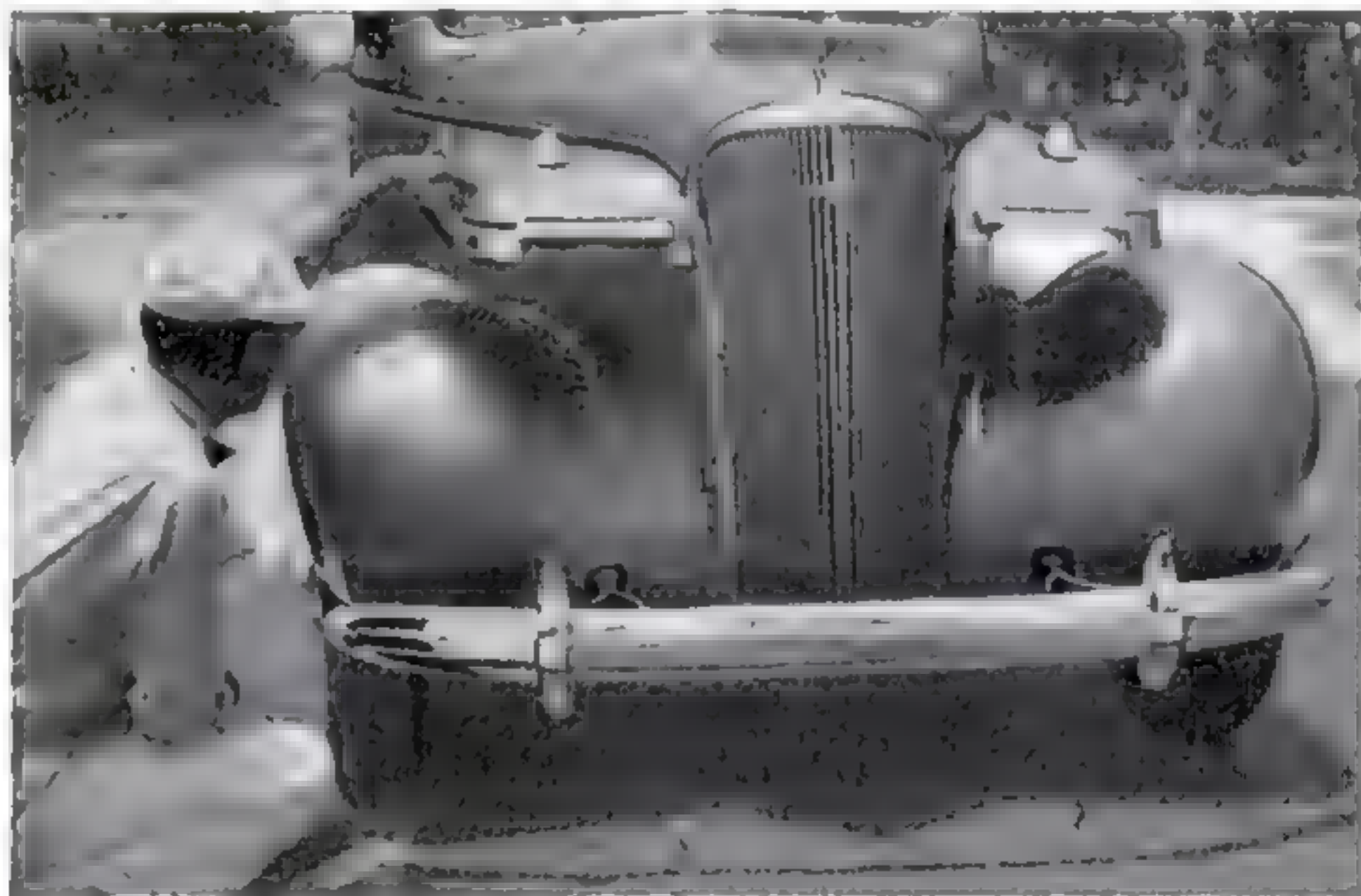
OPERATING on the same principle as the larger sand-blast cleaners for automobile spark plugs introduced several years ago, a new midget portable unit can be moved to any part of the garage and receives its air supply from the regular service-station air hose. A stream of special sand shot at the spark-plug electrodes cleans them of corrosion and soot.



Attached to a garage air hose, the unit sand-blasts spark plugs

Deep-Set Headlamps Reduce Glare

A REVOLUTIONARY type of automobile headlamp is said to produce three times the illumination of standard headlights and yet to eliminate practically all road glare that might blind the drivers of approaching cars. Set more than three feet back of their normal position, the headlights are mounted under an elongated, streamline metal shield that can be tilted up or down by a dashboard control. The shields concentrate and confine the light to the highway immediately ahead.



Front and side views of a car equipped with the novel headlamps. Set far back of the usual position, they are covered by streamline shields



Mrs. Henry Acken at work at her hobby making costume dolls. At left, a group of her dolls dressed in period fashions



Homemade Dolls Show History of Fashions

MAKING and collecting character dolls that show the styles of dress worn during various periods in history is the hobby of Mrs. Henry Acken, of Brooklyn, N. Y., who was crazy about dolls as a little girl, and still is—as a grandmother. Her diminutive historical fashion plates are built around wire

frames, padded with cloth, and fitted with arms, legs, and head modeled from a plastic material. Mrs. Acken, who divides her spare time between dolls and her two other hobbies, cats and cooking, is pictured above with some of her creations.



Photographer Fits Car with Roof-Top Platform

USING four-inch rubber suction cups to hold it in place, Charles J. Long, a Newark, N. J., photographer, constructed a roof-top platform on his automobile to provide an elevated vantage point for taking pictures. To prevent it from slipping, the platform has guy wires that extend to the front and rear bumpers of the car. Fenders are protected by rubber treads, held on with rubber cement so that they can easily be peeled off when the platform is removed. Long recently completed a 16,000-mile, three-month motor trip that took him from Montreal, Canada, to Mexico City, Mexico, and from the Golden Gate International Exposition in San Francisco, Calif., to the World's Fair in New York City. During that extended tour, the platform remained constantly in place, and showed no signs of shifting from its original position in spite of steady use.

Wires and rubber vacuum cups hold the platform in place

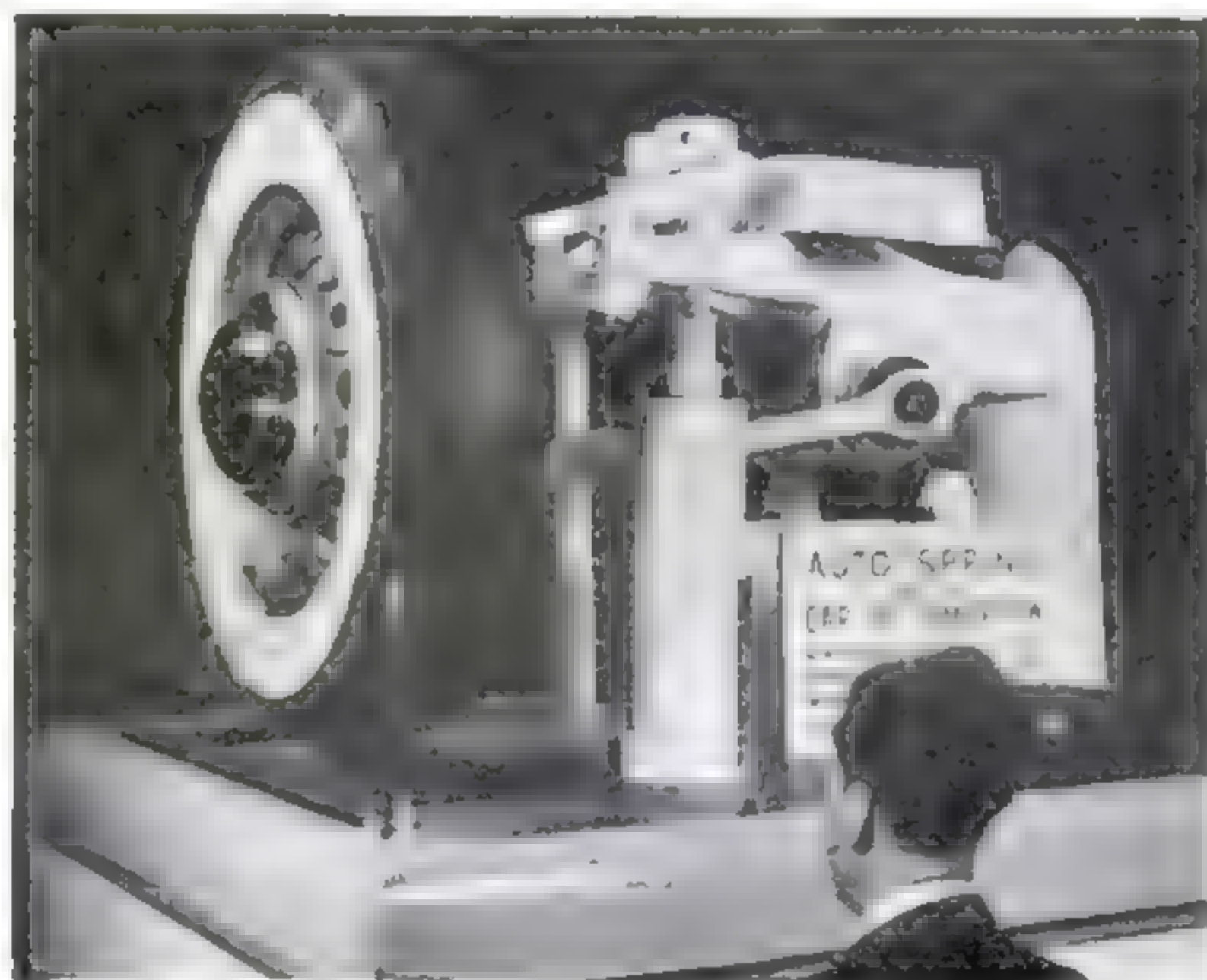


Shrubbery Camouflages Helmet

SHRUB branches sprouting from soldiers' helmets are a form of camouflage now being generally used in wartime to help hide officers and troops from enemy snipers. To facilitate the attachment of this camouflage shrubbery, the steel helmets of British troops are being covered with burlap, or other rough cloth, that is applied in folds to hold shrub stems in place, as shown in the illustration above.

New Spring for Cars Is Made of Rubber

COMBINING the resiliency of rubber with the strength of steel, a new type of automobile spring just announced is said to eliminate the possibility of spring squeaks and rattles, even though it will never require lubrication. Designed as an improvement on the leaf and coil springs now in use, the new car part utilizes three pounds of rubber and weighs only ten pounds when fully assembled. An inner shaft, an outer shell, and a connecting cylinder of rubber bonded between them constitute the unit. One rubber spring will be used for each wheel of a car.



An exhibition model of the resilient rubber-spring assembly

Slip-on Soles Save Fair-Goers' Feet

DESIGNED especially for visitors to the New York and San Francisco World's Fairs, who tread miles of exhibition-building floors and outside pavements on their sightseeing rounds, slip-on rubber soles have recently been placed on the market. Made for both men's and women's shoes, the shock-absorbing live-rubber cushions fit over regular shoes.



Elastic straps hold the auxiliary rubber soles in place on the shoes



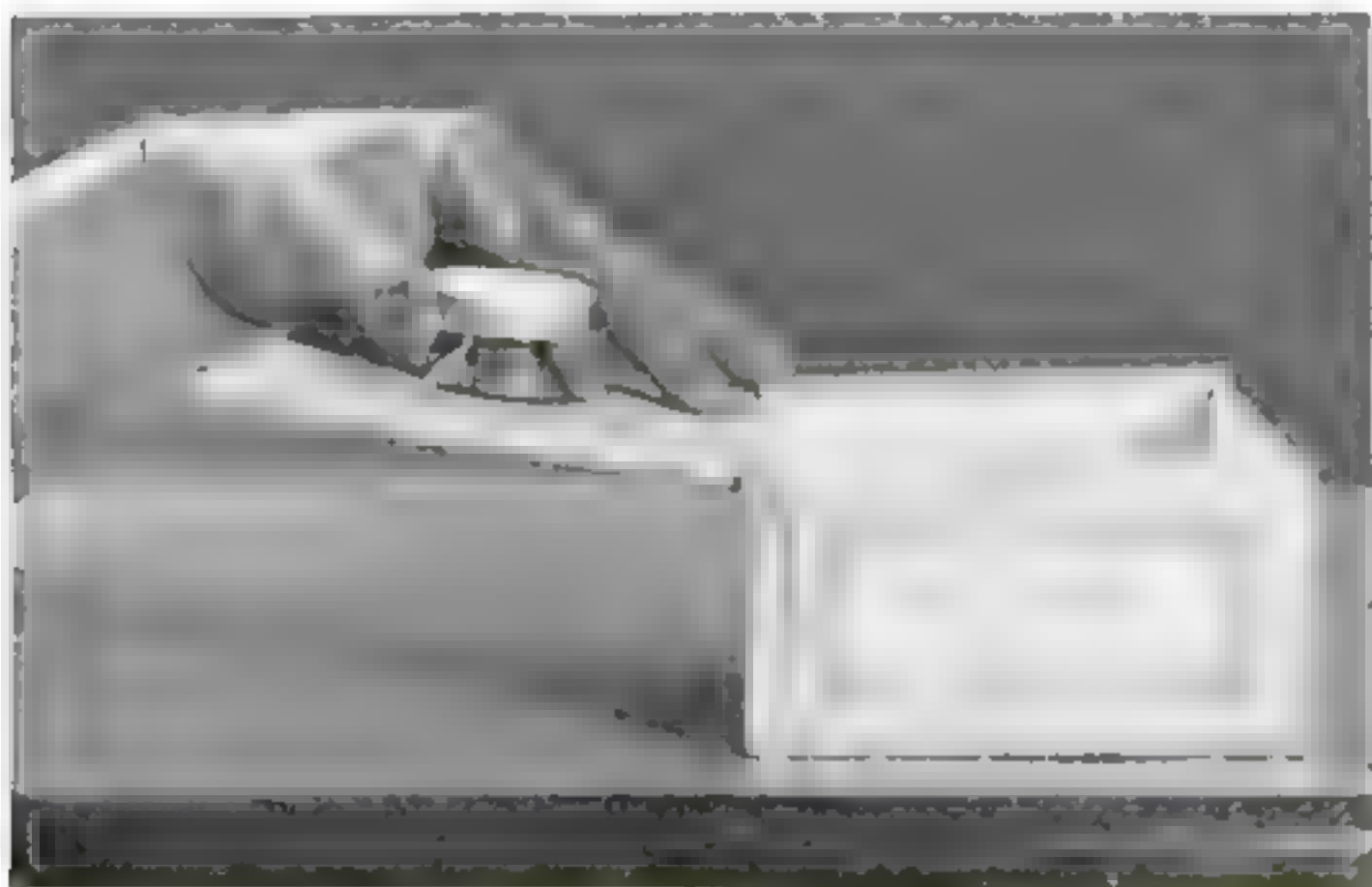
Diesel Tug Tows Ship Single-Handed

IN A convincing test run down the harbor of New York City recently, the tug *Sheila Moran*, a new floating power house in miniature, successfully performed the work normally assigned to a fleet of from three to eight

tugs, and towed the 43,000-ton ocean liner *Ile de France* seaward at four miles an hour, in spite of a strong tide. The test was arranged to demonstrate the power of the 137-ton tug's 900-horsepower Diesel engines.

Moistener for Tobacco Fits Any Humidor

CIGARS, cigarettes, and pipe tobacco are kept moist and fresh by the auxiliary water-holding clay humidifier shown below. The clay is backed by a rubber suction cup so that it may be fastened onto the inside cover of a cigar box or other tobacco container.



A suction cup holds the humidifier in place



Handy Magnifying Glass

A SIX-POWER magnifying glass mounted at the top of a coil spring so that it is adjustable in a vertical direction, is a handy and very inexpensive accessory just marketed for hobbyists who collect and study postage stamps, queer stones, botanical specimens, butterflies, and other items. The unit may also be used to great advantage by amateur photographers for examination of negatives.

Something New in Pets— **A Tame Woodchuck**

A WOODCHUCK that eats pretzels, climbs trees, and opens a screen door when it wants to come into the house, is the odd pet owned by L. G. Lessig, of Newark, N. J. Two summers ago, the baby groundhog was found near the Lessig summer cottage in northern New Jersey. Fed milk from a baby bottle, it grew rapidly and quickly expanded its diet to carrots, wheat, tomatoes, crackers, and clover. When the family returned to Newark in the fall, the pet woodchuck returned with them. It would roll on the floor, play with spools like a kitten, and romp with its owners without the least show of ill temper. When summer came again, the pet traveled back to the cottage and established itself in a hole under the front porch. "Sleeping out" nights, it acquired the knack of opening the screen door and coming into the house for food and play during the daytime.

"Chucky" enjoys a pretzel with his mistress, Mrs. L. G. Lessig. He is also very fond of beer



The pet woodchuck is as playful as a kitten. At the upper right, it is climbing a tree to browse on the tender green shoots

At the right, the groundhog lunches on a dish of crackers and milk. He sits on his haunches, using his tail as a leaning post



Magnifying Spectacle Lenses Aid the Partially Blind

THREE hundred percent magnification for distant vision is said to be provided for the partially blind by new cone-shaped spectacle lenses devised by a western oculist. Combinations of from three to five lenses are possible for each eye and, although the lenses are approximately one inch long, they are light enough to be worn in the frames of ordinary spectacles.

Monkeys Work for Botanists, Collecting Tree Specimens

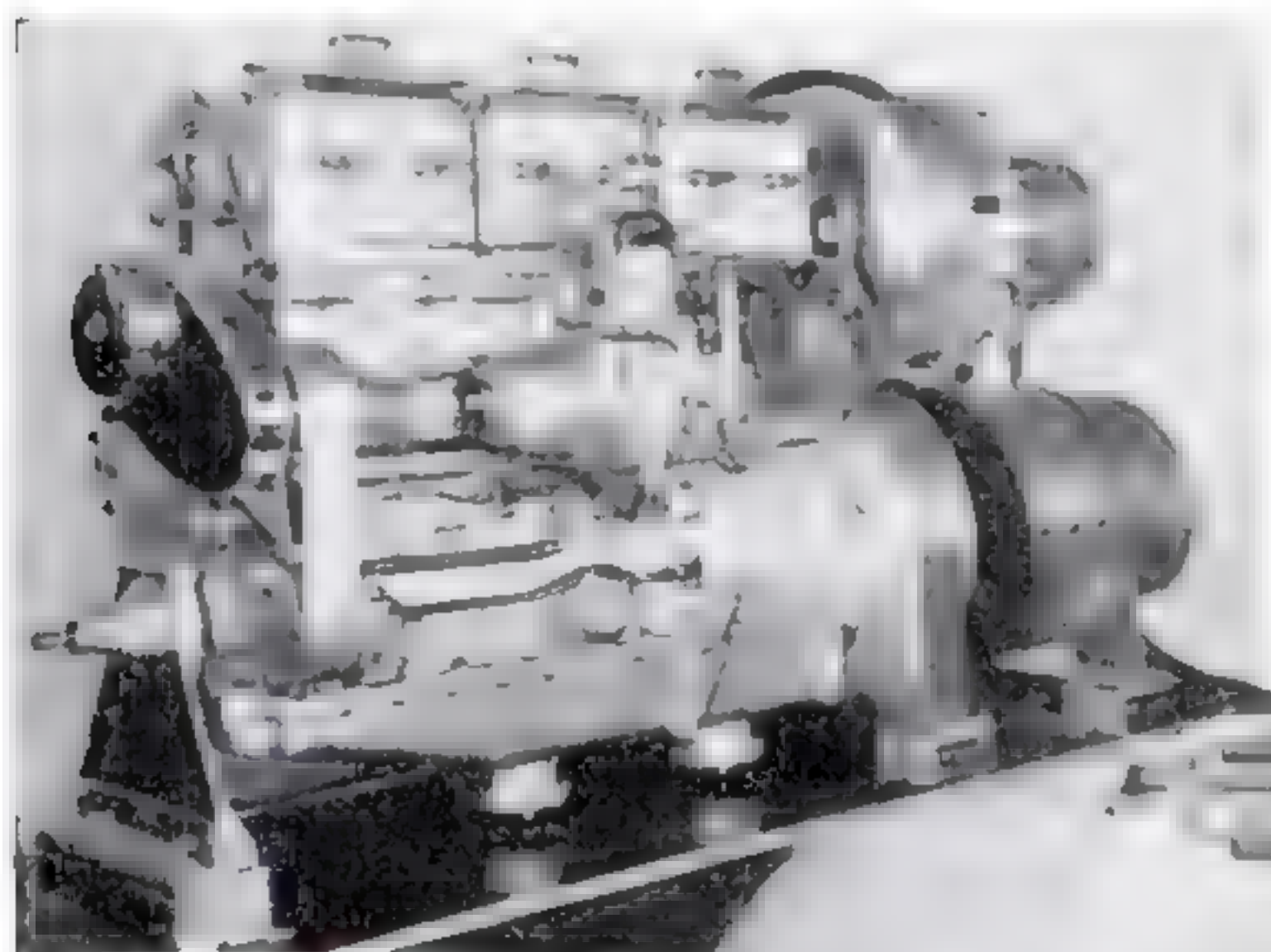
BEROK monkeys, widely used by Malays in the East for gathering coconuts, have been pressed into service by scientists to collect botanical specimens from tall trees. Jambul and Putch, two young beroks who work for the director of gardens at the Straits Settlements, have been taught twelve words of the native language so that they can be instructed to pick specific twigs.



Soundproof Generator Truck for Movies

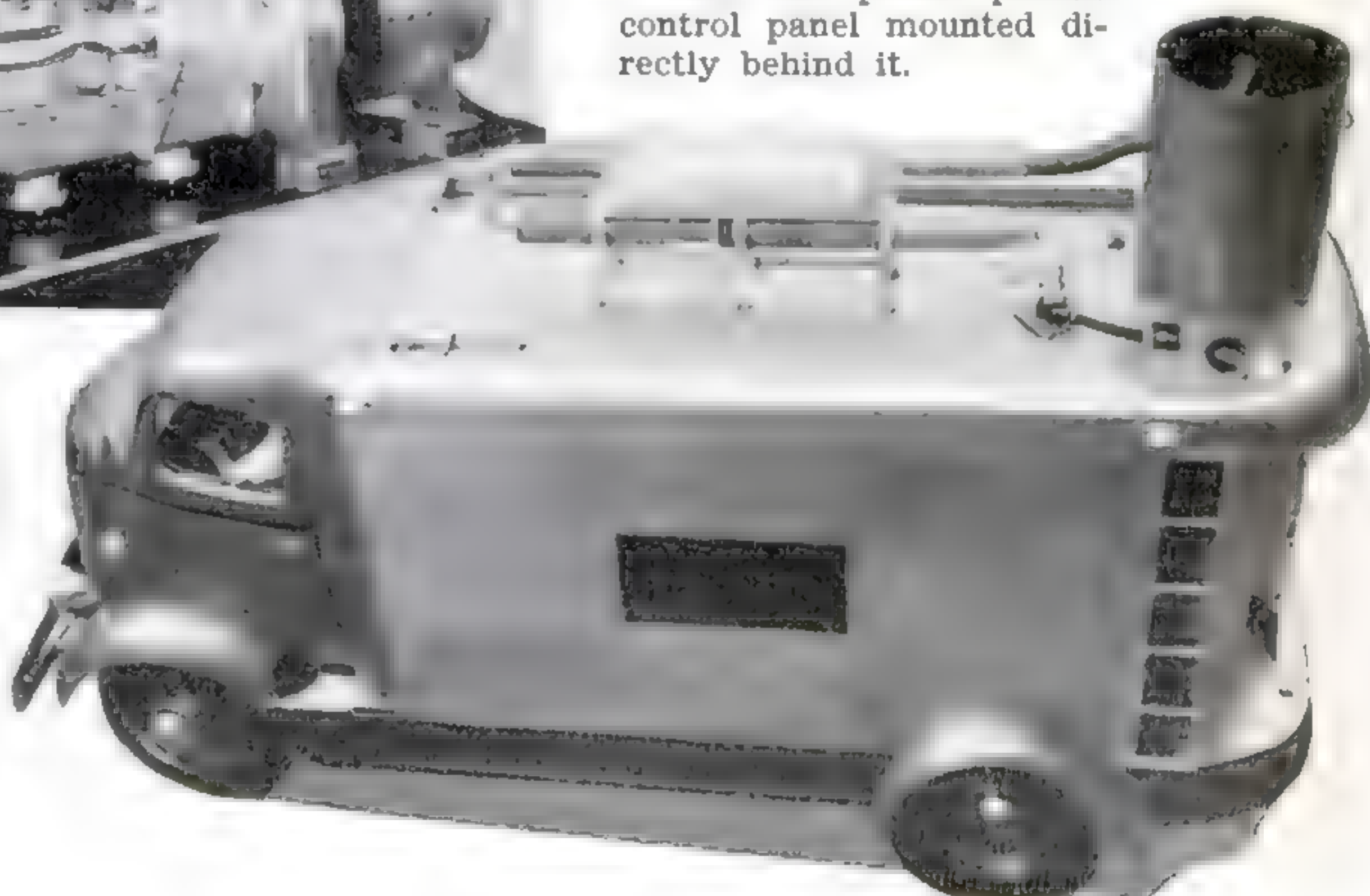
WITH a fourteen-foot muffler on the roof of its all-metal body, a new sound-tight truck produces electric current for movie com-

panies on location without interfering with the sound recording. It can be used as close as 100 feet from the set and still the sensitive microphones will not pick up the throb of its high-speed Diesel engine spinning the electric generator within the inclosed body of the \$24,000 mobile power plant. Built entirely of duralumin, the truck has triple walls, with one-inch air spaces between. The steering wheel of the truck pulls out of a socket, permitting the driver's seat to be reversed to face the power plant's control panel mounted directly behind it.



High-speed, four-cylinder Diesel engine and generator used in the mobile unit for generating power on movie sets

Exterior view of the truck. On top are the fourteen-foot muffler and a chimney housing radiators and fan



Hatching



SEVENTEEN stories above one of the busiest streets in New York City, America's strangest livestock farm has its barns and pastures. The barns are glass jars. The pastures are mesh-inclosed cages. And, the product of this skyscraper ranch is house flies—5,500,000 flies a year!

The unique enterprise started ten years ago when scientists of an insecticide company wished to make exact tests of the effectiveness of their product. They needed normal, healthy flies on which to test the sprays. From this small beginning, the fly farm has grown to the mass-production activity of today.

Under the direction of Dr. Alfred Weed, as many as 15,000 flies a day are turned out for a wide variety of uses. The majority end their days in spraying tests conducted in the laboratory where they are born. But others are purchased for different uses. Mrs. Norman Bel Geddes, wife of the noted industrial designer, once put in several orders for flies to feed a pet chameleon. Another New York woman, who returned from Florida with a pair of tiny tree toads, called the laboratory to inquire the price of a dozen houseflies a day for her pets. During the past summer, 5,000 flies a day have been supplied for one exhibit at the New York World's Fair.



Separating the fly pupæ from the culture medium for shipping

All these insects grow up under exactly the same conditions. Air-conditioning apparatus keeps the humidity and temperature in the glass-inclosed fly farm the same from day to day. Ordinary flies, breeding in filth, are oftentimes troubled with mites. Insects infested with these minute parasites have reduced vitality and succumb to poison sprays more easily than healthy flies. To insure uniform results, all flies used for testing insecticides have to be free from parasites.

By raising his winged livestock under care-

House Flies for Profit

IN AN ODD SKYSCRAPER FARM,
DOMESTIC PESTS ARE RAISED
FOR MANY CURIOUS PURPOSES

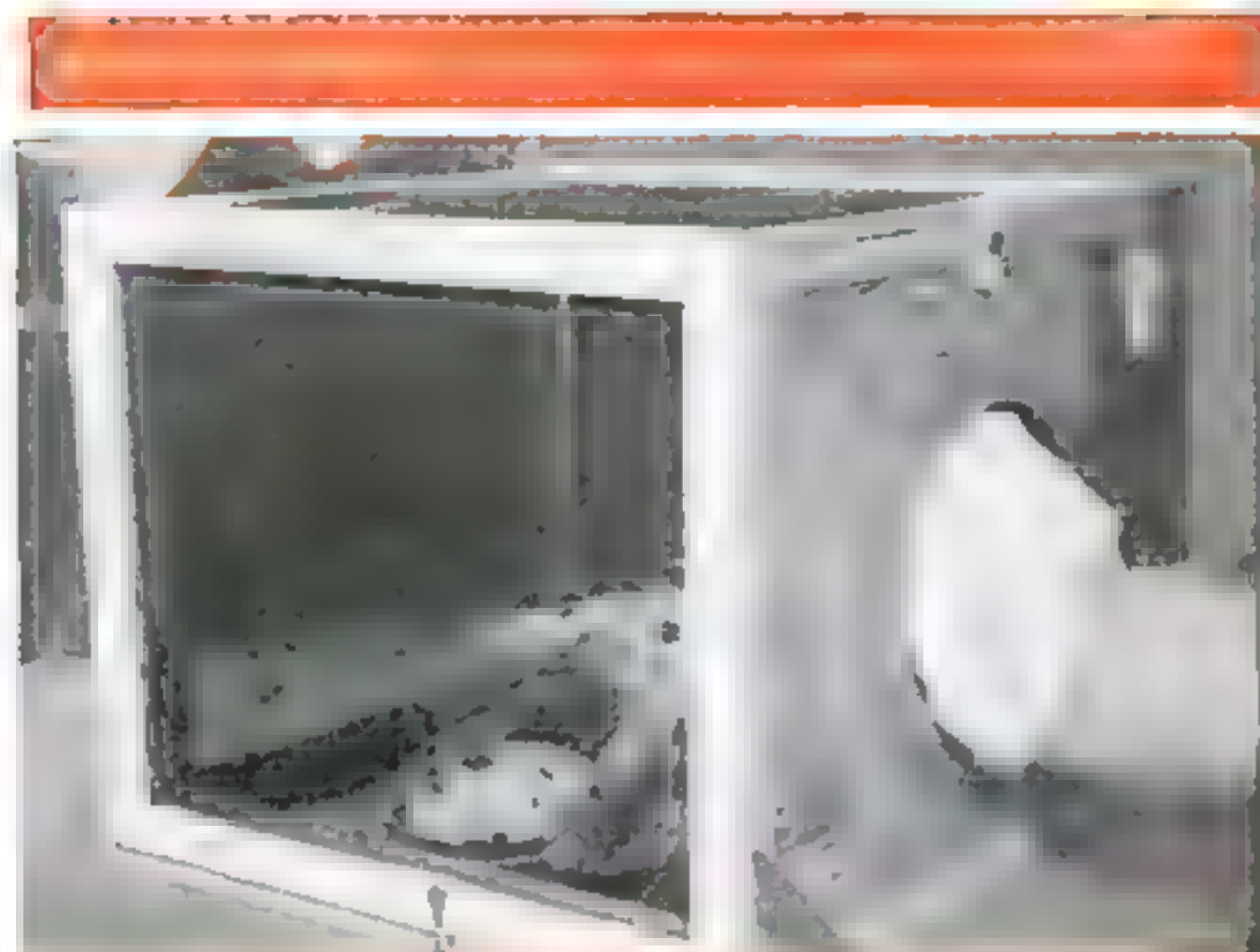
By FRANK CAPORAEI



A corner of the fly farm. The culture jars are seen at the left and the fly cages at the right

fully controlled conditions, Dr. Weed is able to produce millions of flies that meet this requirement. The adult insects, housed in mesh cages, feed upon water and milk. The eggs laid by the "breeding stock" are carefully seeded in jars filled with a mixture of bran, brewer's yeast, malt and alfalfa.

The complete growth cycle of the fly, from egg to adult, consumes about ten days. For more than half of this time, the larvæ, or maggots, feed and burrow through the mixture in the jars. Then they turn into tiny brown pupæ which are collected for shipment. Mailed in cardboard tubes, they produce adult flies about three days later.



Adult flies are kept in cages like this. They lay their eggs in a metal receptacle



Here the pupæ are being gathered up. Flies are shipped in this quiescent state

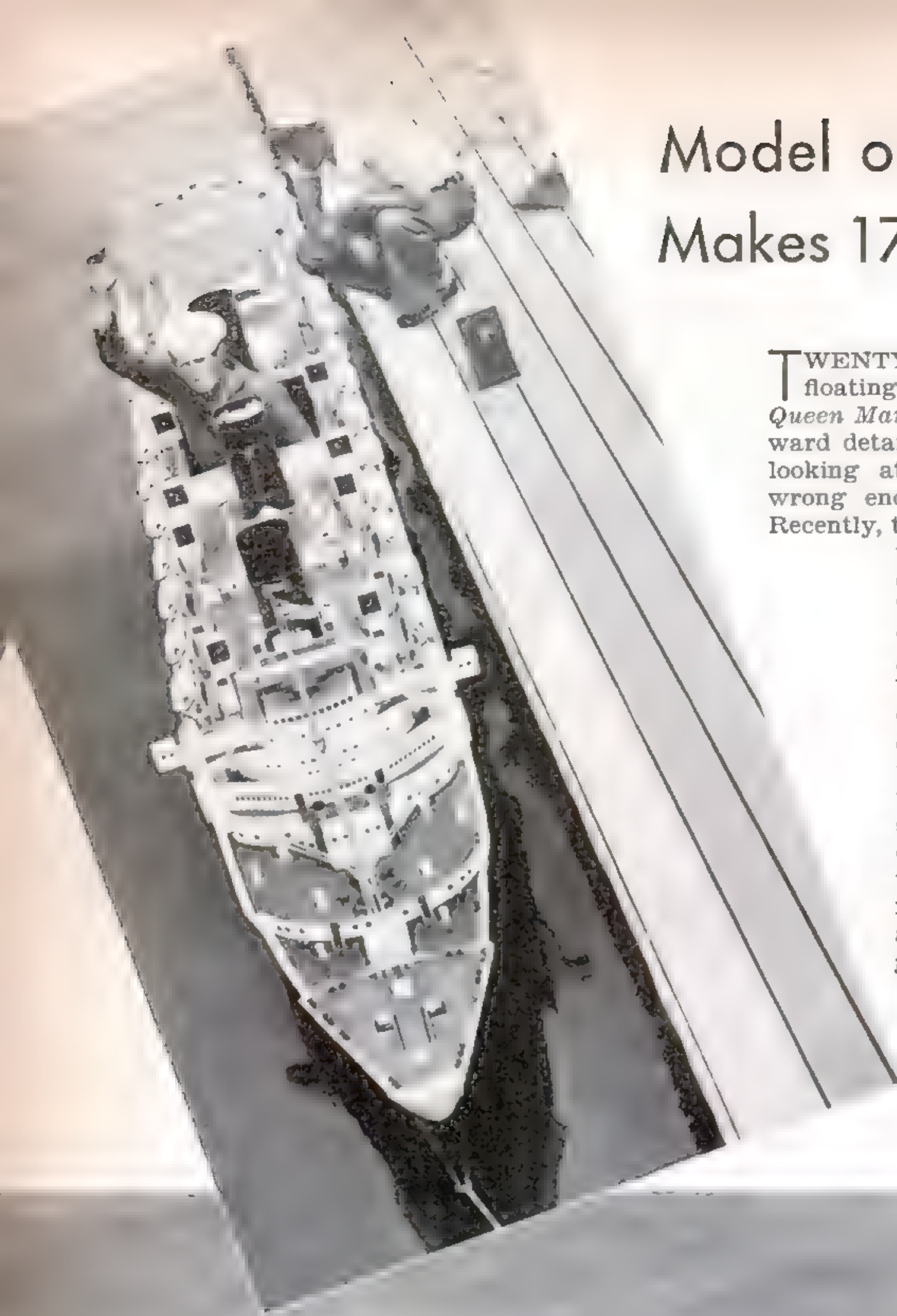


Pouring fly pupæ into a tube for mailing

Model of Ocean Liner Makes 17-Day Voyage

TWENTY-TWO feet long, a remarkable floating model of the transatlantic liner *Queen Mary* is so complete in every outward detail that observers feel they are looking at the real ship through the wrong end of a high-power telescope. Recently, the craft made a seventeen-day voyage under the power of her own diminutive engine from Toronto, Canada, through Lake Ontario, the Erie Barge Canal, and the Hudson River to the World's Fair in New York City, where she tied up to a dock in the Fair's yacht basin for inspection. Despite the fact that the boat is only thirty-one inches wide, she carries a crew of two. Two views of the trim little craft soon after she made moorings at the Fair, are reproduced in the photographs below and at the left.

The "Queen Mary" in miniature, as she arrived in New York from Toronto recently under power of her own engine



Constructed from memory, the model runs on coal, oil, wood, or compressed air

Live-Steam Model Locomotive Is Fashioned from Scraps



MADE entirely by hand with scrap metal as the only material, the four-foot working model of a Pacific-type, 2-4-4 locomotive, pictured above, was completed recently by a Jackson, Mich. model maker. Constructed from memory after a locomotive running on

a line on which the craftsman once worked, the engine weighs 180 pounds, operates on coal, oil, rags, wood, or compressed air, and is said to pull a load of 500 pounds with ease. Two years were required to complete the realistic model.

The House A Jackknife Built

A JACKKNIFE was the one and only tool used to construct the elaborate model house shown in the photograph below. Carved out by seventy-eight-year-old Harry Patterson, once a circus trapeze acrobat and now a New York City restaurant owner, the model was made from black walnut and hazel woods at a total cost for materials of twelve dollars. The model house was patterned after the maker's boyhood home.



Plastic Sun Glasses Have No Frames

FLEXIBLE and extremely light in weight, sun glasses of a new type are made without frames. Designed with a cut-out section to accommodate the nose, the glasses consist of a strip of glare-cutting plastic material which is bent across the eyes and around the temples. It is held in place by short bows that fit over the ears.



It took four years' spare time to carve and assemble this house

New Toy Projects Pictures with Sound



As pictures are projected on a screen, a phonograph record describes them

SIMPLE to operate, a combination projector and phonograph recently introduced by a toy manufacturer projects still pictures with synchronized sound accompaniment. Films are inserted in the projector in the normal way, and records are played on the built-in phonograph. When a signal gong sounds, the operator presses a lever to throw a new picture on the screen.



Stretching a V belt between two grooved saddles, one sliding over a scale, gives the size of the belt

Slide Rule Finds Size of Worn-Out V Belts

WITH a new machine-belt measurer that simplifies replacements, worn-out V-type belts are slipped over grooved saddles on a special slide-rule device. One of the saddles is moved along the rule until the belt is taut. The size is then read from a convenient scale, as illustrated above.

Turbine-Steel Tester

IN A new tester for steels to be used in steam turbines, an automatic hammer strikes a red-hot sample of the metal with 2,600-pound blows at the rate of 600 a minute. A total of 10,000,000 individual impacts is given to each test sample.

Zinc-Plate Thickness Gauge

THE THICKNESS of the thin layer of zinc electroplated onto the surface of another metal can now be measured to within a hundred-thousandth of an inch by a new process that consists of timing with a stop watch the period required for a measured amount of a special chemical to eat through a section of the plating.



By clocking the time taken by chemicals to eat a hole in the zinc plating, the thickness of the deposit is gauged



Some of the historic rolling stock on exhibit in the railroad pageant presented at the New York World's Fair

Locomotives Are Stars in Railroad Show

POURING clouds of steam skyward, full-size locomotives running under their own power play the leading roles in an impressive railroad pageant which is one of the outstanding hits at the New York World's Fair. Depicting the high spots and historical events in the history of railroad transportation in the United States, twenty live-steamers are supported by a cast of 250 actors and actresses in reenacting such historic scenes as that which occurred at Promontory Point, Utah, in 1869, when, between the puffing smokestacks of the Central Pacific's *Jupiter*, and the Union Pacific's 119, the last spike was driven to complete the monumental task of laying track for America's first transcontinental railroad. For the grand finale of the pageant, instead of having the conventional curtain drawn across the stage, two giant modern loco-

motives, the Pennsylvania's streamline 3768 and the Delaware, Lackawanna, and Western's 1939, christened the *Pocono Mountain*, chug onto the mammoth stage from opposite sides and touch cowcatchers to close the show.



Coach, canal boat, and early locomotive meet in a scene depicting the gradual evolution of American railways

INDIANS USE MODERN MEANS TO CATCH SALMON



Indian fishermen dipping
their winter food supply
from the Columbia River

A helper on top of the cliff hauls up the catch from the stage hanging below

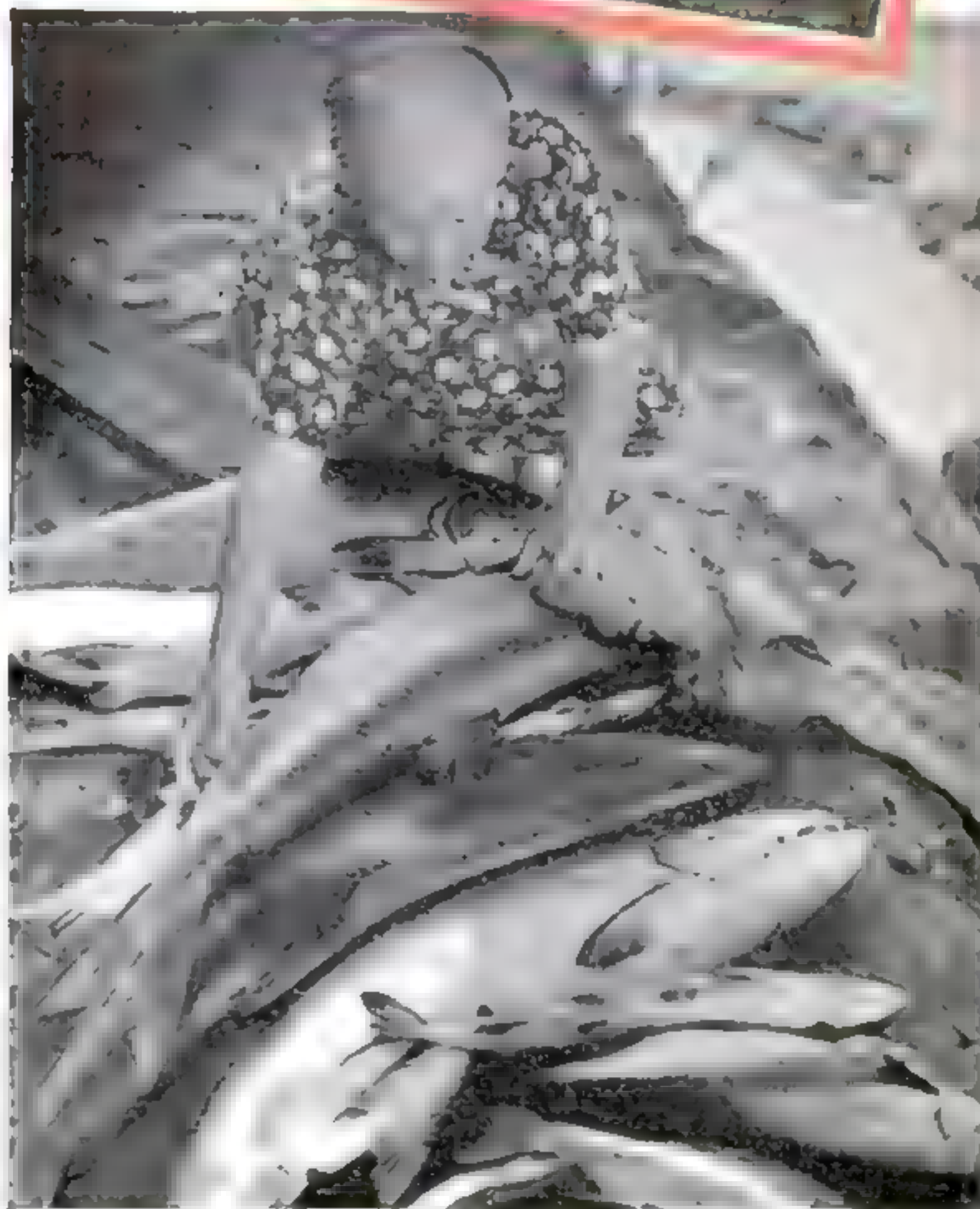


A big fish brought up by the long-handled net gets the coup de grace with a heavy club



Heap Good Fishing

PERCHED on wooden stages lowered down the jagged sides of the canyons bordering the swirling waters of the Columbia River near Celilo, Ore., Indians are using modern methods to net choice salmon that provide them with an important part of their annual food supply. Exercising their inherited fishing rights in this territory, guaranteed them under treaties made with the white men by their ancestors, the Indians trek down from their near-by reservations for the annual run of salmon up the Columbia to spawning grounds. But instead of employing the spears and crude nets their feathered and painted forefathers used, the modern braves make use of large long-handled nets and modern methods. Supported by cables anchored near the



Transportation is in charge of squaws who wrap the fish in gunny sacks and cart them home in late-model autos

Here an Indian boy is hauling himself across the swirling rapids in a crude aerial tramway consisting of a box suspended on a big cable

lips of narrow canyons where the fishing is best, the wooden platforms are lowered down the canyon walls within easy reach of the roaring torrent below. With each dip of the net into the swirling foam, an Indian fisherman usually nets a good-size salmon, which is quickly dispatched with a blow on the head and hauled to the top of the rock cliff by an assistant stationed above. Squaws load the catch, which may exceed 200 pounds a day, into gunny sacks to be carted home—not slung across the saddle of an Indian pony, but neatly stacked in the luggage compartment of the family's late-model automobile. At home, the fish are cleaned and dried for storage, although part of the catch is sometimes loaded into a small boat for a downriver trip to a salmon cannery.

In their fishing, these Oregon Indians, like the white fishermen, take advantage of the salmon's habits and mode of life. The salmon begin their life cycle in the freshwater rivers that empty into the Pacific Ocean between California and Alaska, sometimes as far as 1,800 miles upstream from the coast.

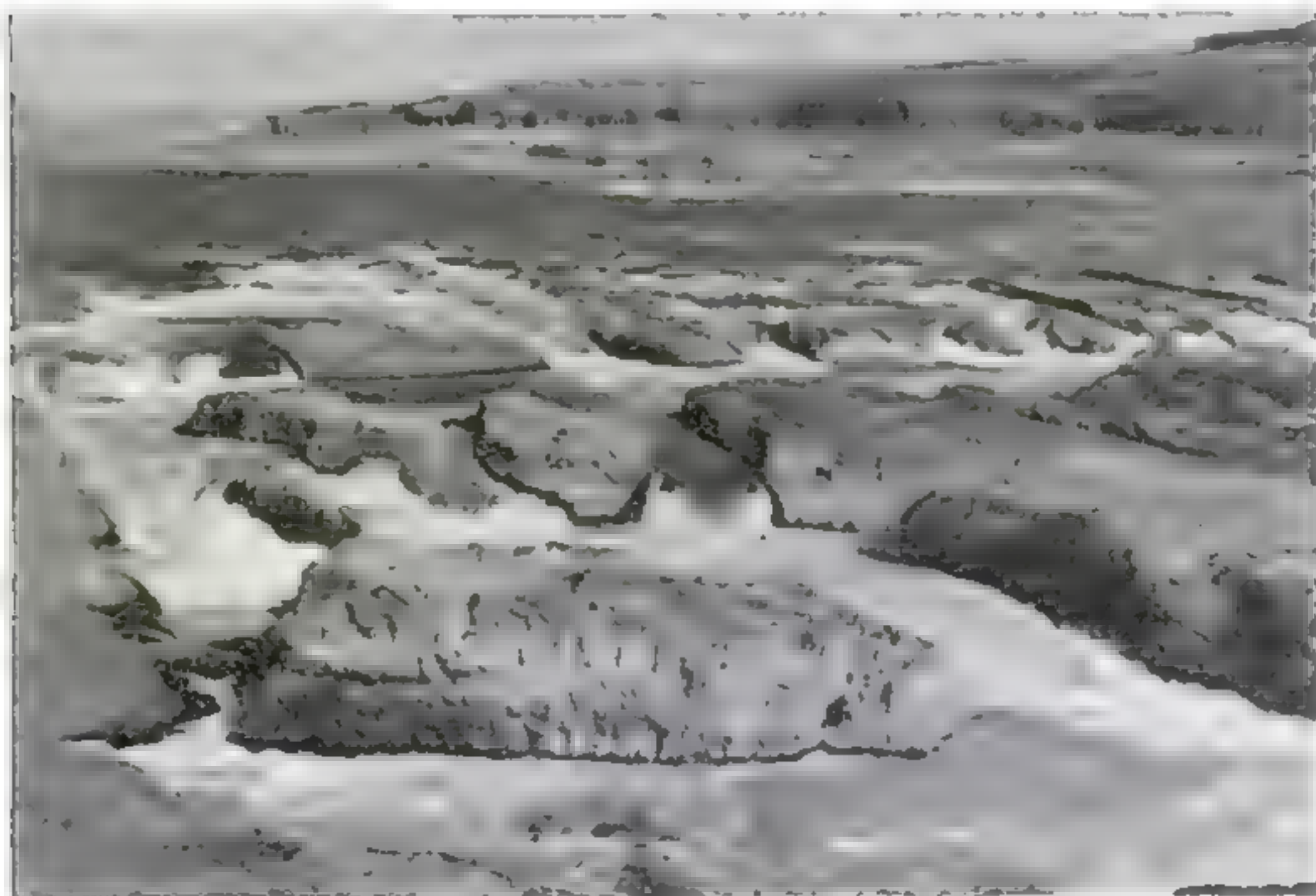
Some of the small fish start downstream toward the sea soon after hatching, while others remain in fresh water for a year before heading seaward. In the ocean, the salmon's habits are still something of a mys-

tery to scientists, but it is definitely known that most salmon return to spawn in the exact stream in which they were hatched.

Fighting their way through tumbling torrents and up over huge waterfalls, the fish

reach quiet upstream waters, where the females lay their eggs in shallow troughs in the stream bed, and the males fertilize them by swimming over the nests and extruding milt, a reproductive secretion. Without exception, the parents then become scrawny and emaciated, dying before the eggs hatch.

By concentrating their fishing during the months when the adult salmon are fighting their way up the river to spawn, the Indian fishermen are assured of large catches of good-size fish.



Happy fishing grounds: a typical scene on the Columbia near Celilo, Ore.

Bike for Winter Use Has Three Wheels



McDaniel riding his remodeled bicycle. The twin front wheels prevent spills on skiddy pavements

Midget Hot-Water Bottle Soothes Toothaches

A DOLL-SIZE hot-water bottle now on the market is said to be a handy medicine-cabinet accessory for use in the treatment of toothaches and similar ailments. Fitted with a leakproof rubber stopper, the bottle has a neck large enough to admit crushed ice, so that it may also be used as an ice pack.

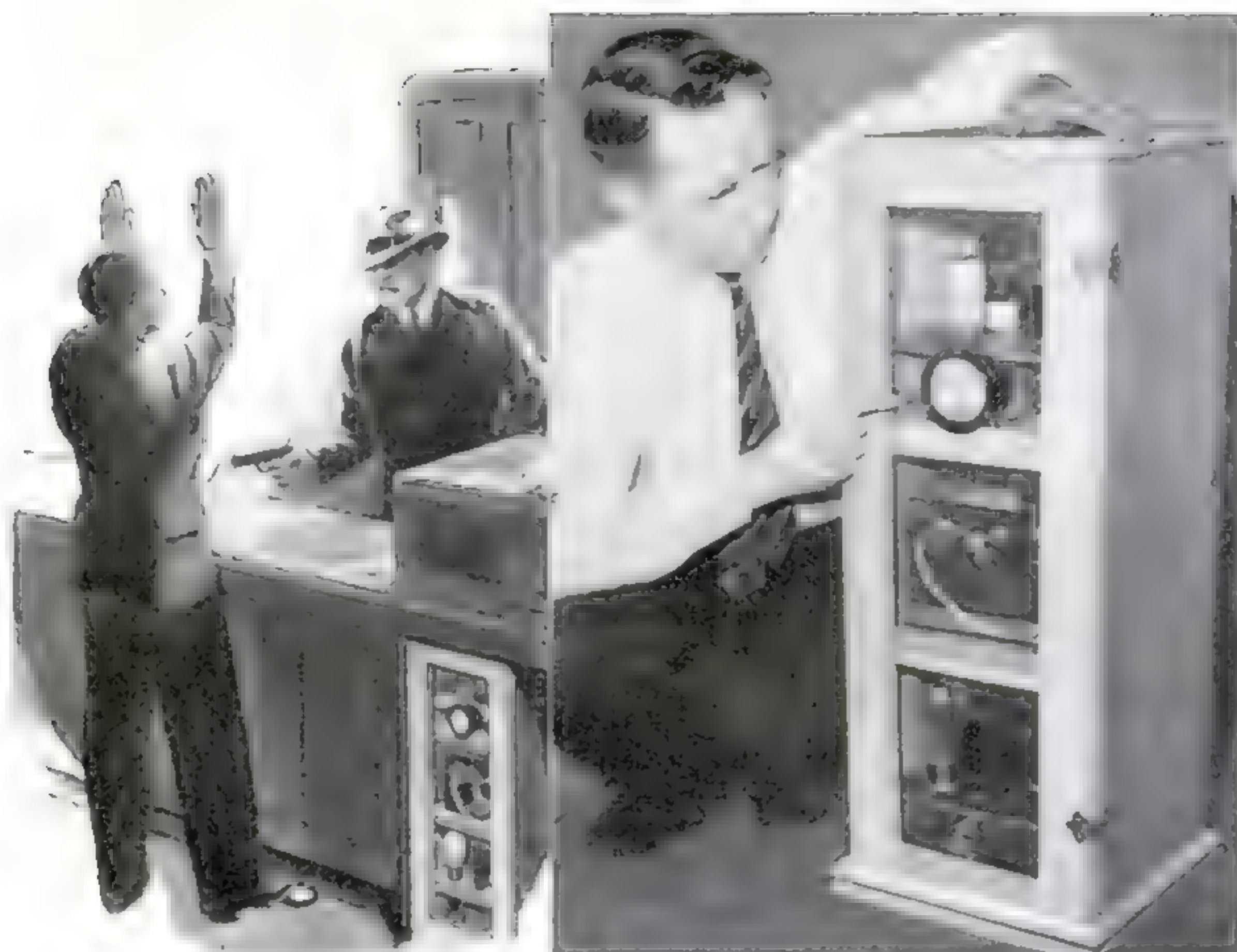


How the bicycle fork was rebuilt to add an extra wheel. The front wheels are thirty inches apart

License Tag in Miniature Identifies Auto Keys

A METAL tag stamped out as a miniature reproduction of your automobile license plates is attached by a chain to a novel key ring designed to hold car keys. Tiny copies of any individual license plate of any state may be obtained. The identifying tags are especially useful where a number of sets of keys to different cars are kept in one place, as in a public garage.





Touching a concealed pedal turns on the automatic transmitter to broadcast a recorded call for help

The phonograph and a transmitter tuned to the police-radio wave band are housed within one cabinet

Short-Wave Holdup Alarm Calls Cops

PERMANENTLY tuned to the police-radio frequency, a short-wave transmitter serves as an automatic burglar alarm for stores, banks, and other establishments that might be subject to holdup or robbery. When

armed theft of any kind is attempted, a clerk, teller, or other employee simply trips a hidden key, and the transmitter automatically broadcasts to police a previously recorded alarm message.



Held against a whirling abrasive, an article's ability to resist wear is measured on a calibrated lever

Portable Electric Tester Checks Samples for Wear

WILL it wear well? To answer this question made by prospective quantity buyers of merchandise, a portable electric tester is now available. Samples are held against abrasives on a whirling turntable. A calibrated lever and an automatic counter that registers turntable revolutions, supply the answer.

Beauty-Shop Ear Guards

PAPER ear muffs, recently introduced, are designed to be worn by customers in hairdressing parlors and beauty shops while they are sitting under an electric hair-drying machine. The muffs protect the customer's ears from the heat and noise produced by the drier.

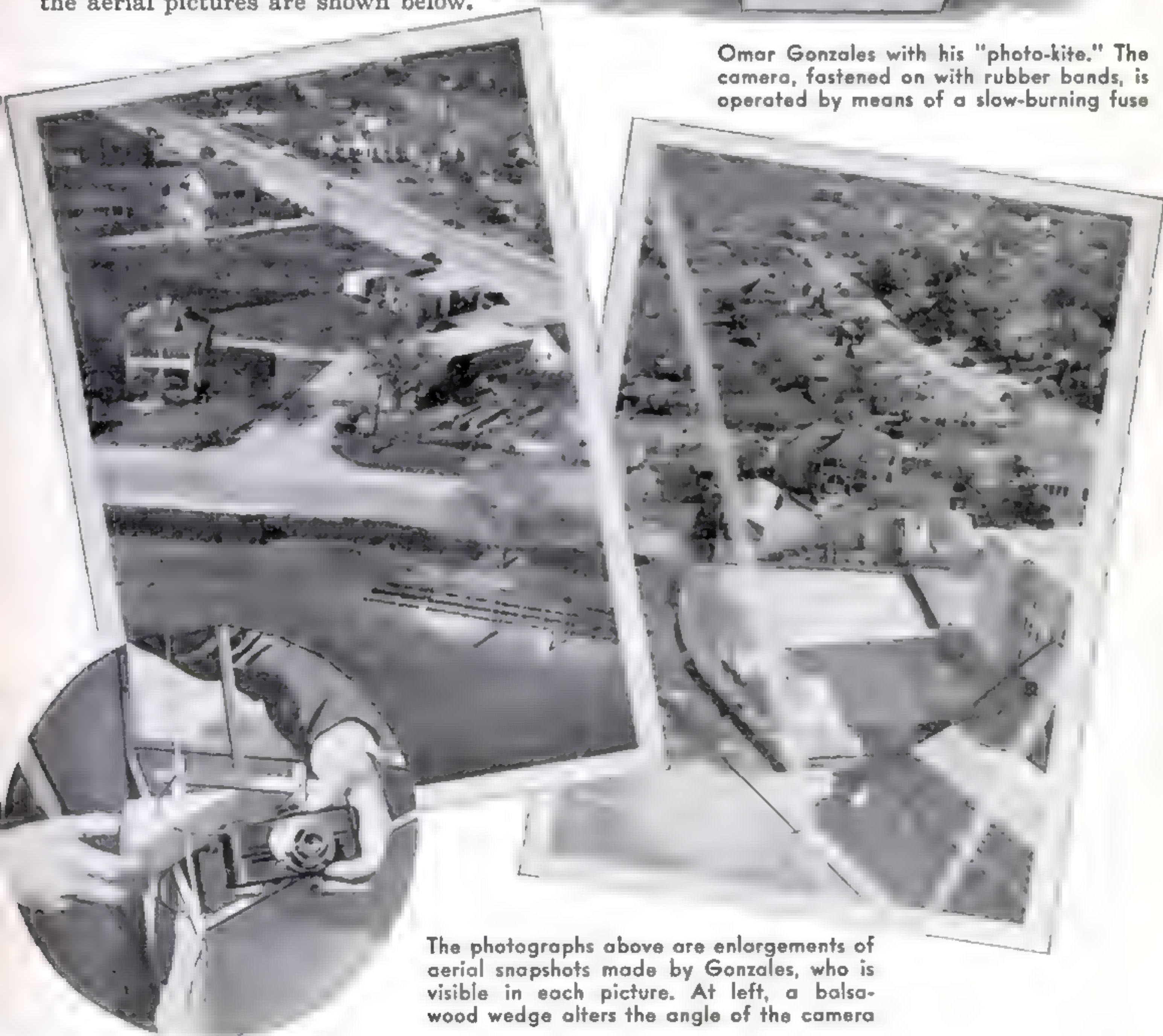


Small Camera on Box Kite Gets Good Aerial Photos

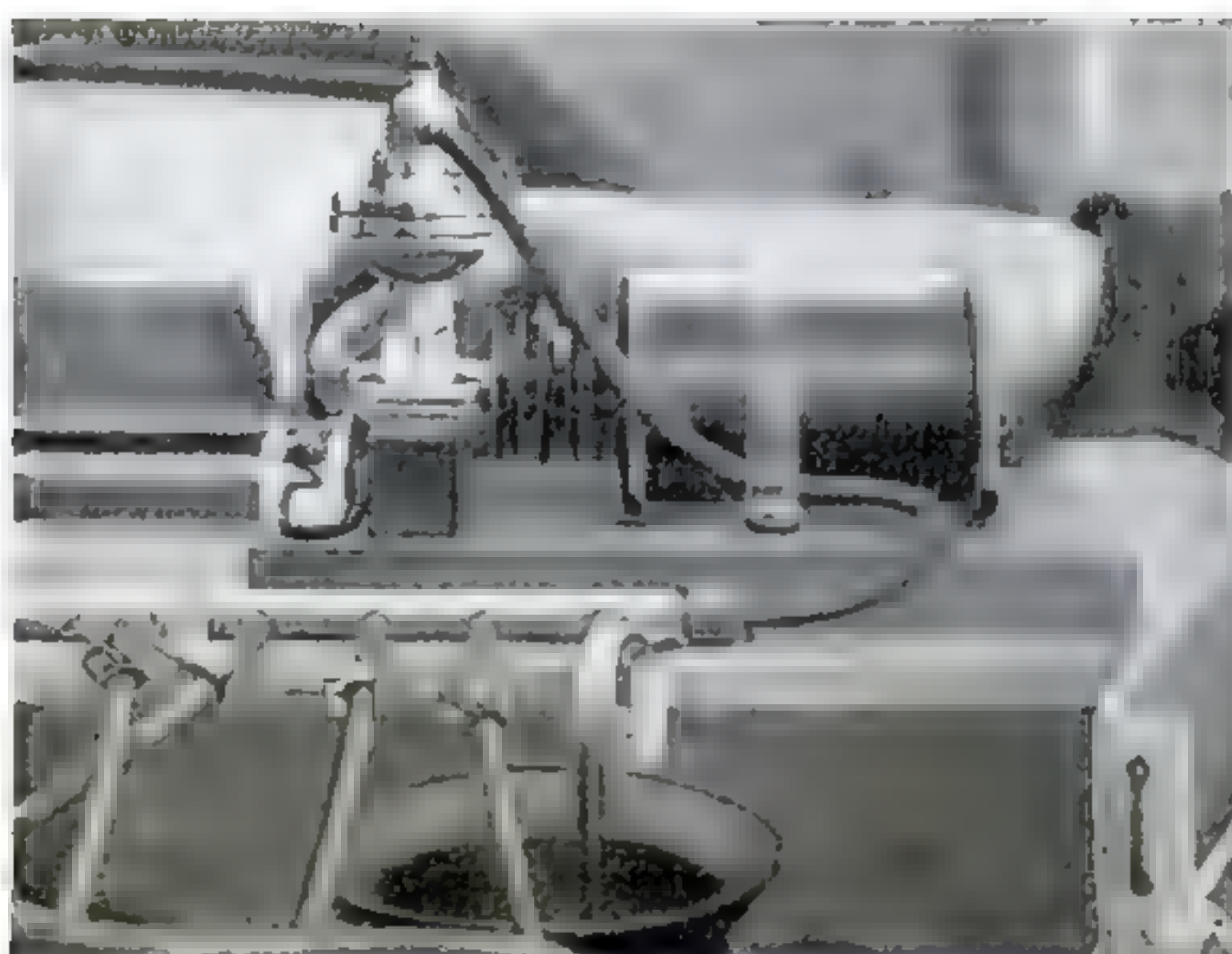
SOARING 500 feet above the ground on a homemade triangular box kite, an inexpensive miniature camera snaps remarkably clear aerial photographs for Omar Gonzales, of San Antonio, Tex. Before launching his kite into the air, Gonzales lights a slow-burning fuse which snaps the picture after an interval by severing a string and allowing a rubber band to throw the shutter release. A tiny flag then flutters to the ground as a signal that the photograph has been taken. The area to be snapped is controlled by maneuvering the kite, and special camera angles are obtained by the use of a wedge-shaped camera-mounting block. Two samples of the aerial pictures are shown below.



Omar Gonzales with his "photo-kite." The camera, fastened on with rubber bands, is operated by means of a slow-burning fuse



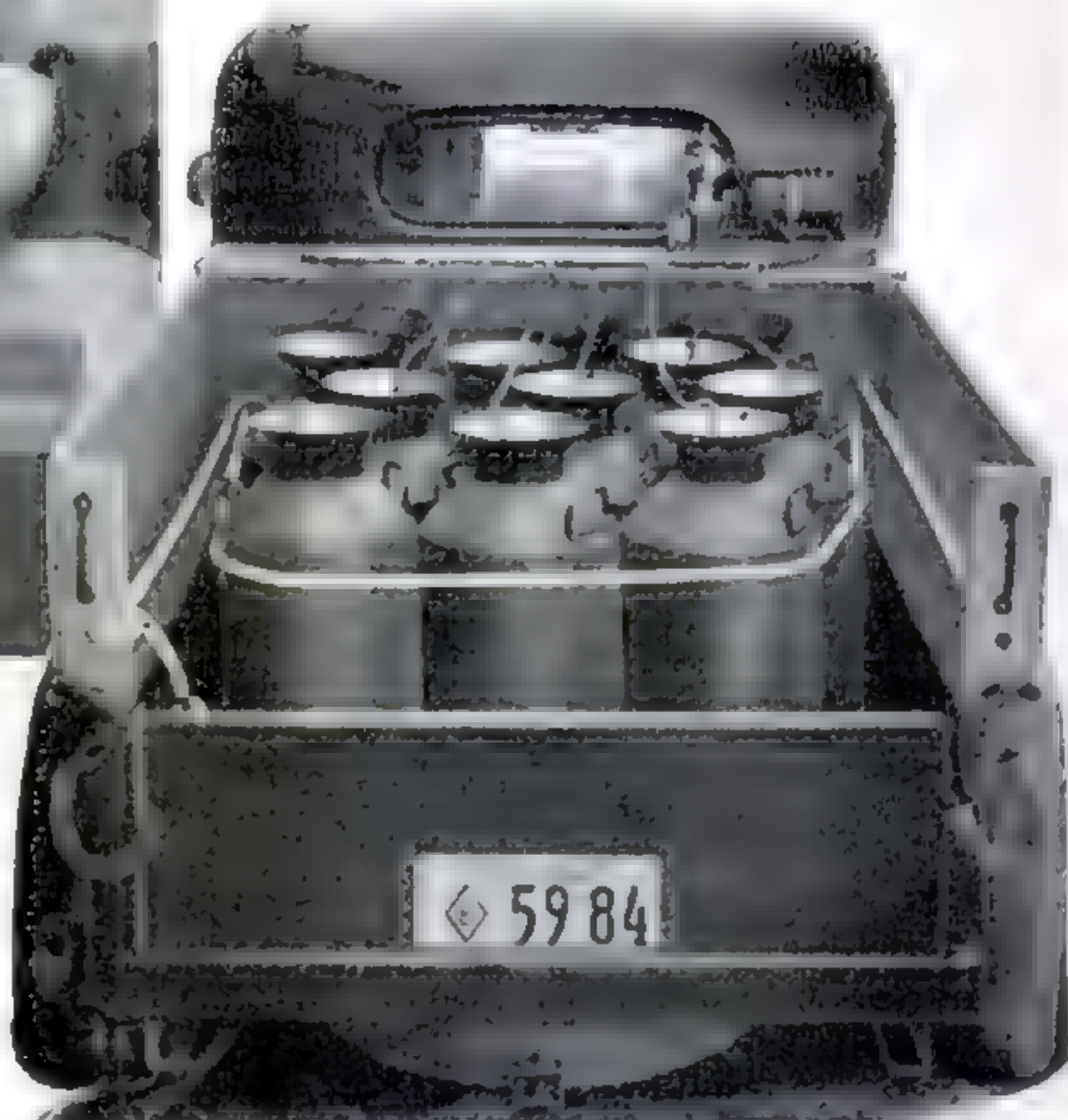
The photographs above are enlargements of aerial snapshots made by Gonzales, who is visible in each picture. At left, a balsawood wedge alters the angle of the camera



Mounted behind the truck cab, the pump supplies air through flexible tubes to special nozzles submerged in the fish-carrying cans

Electric Pumps Supply Fresh Air for Fish During Transportation

OF THE 50,000,000 small fish being transplanted this year from hatcheries and dead waters to streams and lakes by California conservation officials, few will fail to survive the overland truck journey, thanks to a novel water-aërating system installed on each truck. The installation consists of a battery-driven air compressor, mounted directly behind the truck cab, which pumps a constant supply of air to a manifold. The latter then distributes the air through rubber tubes terminating at the bottom of each of the ten-gallon fish cans within the body of the truck. At the end of each tube, a special porous nozzle sprays the air through the water in the container, thus insuring a continuous supply of oxygen to keep the water fresh at all times. With this new equipment, it is expected that only a small fraction of former fish-transporting losses will be suffered in the future.



Shoe Gauge Gives Length and Width



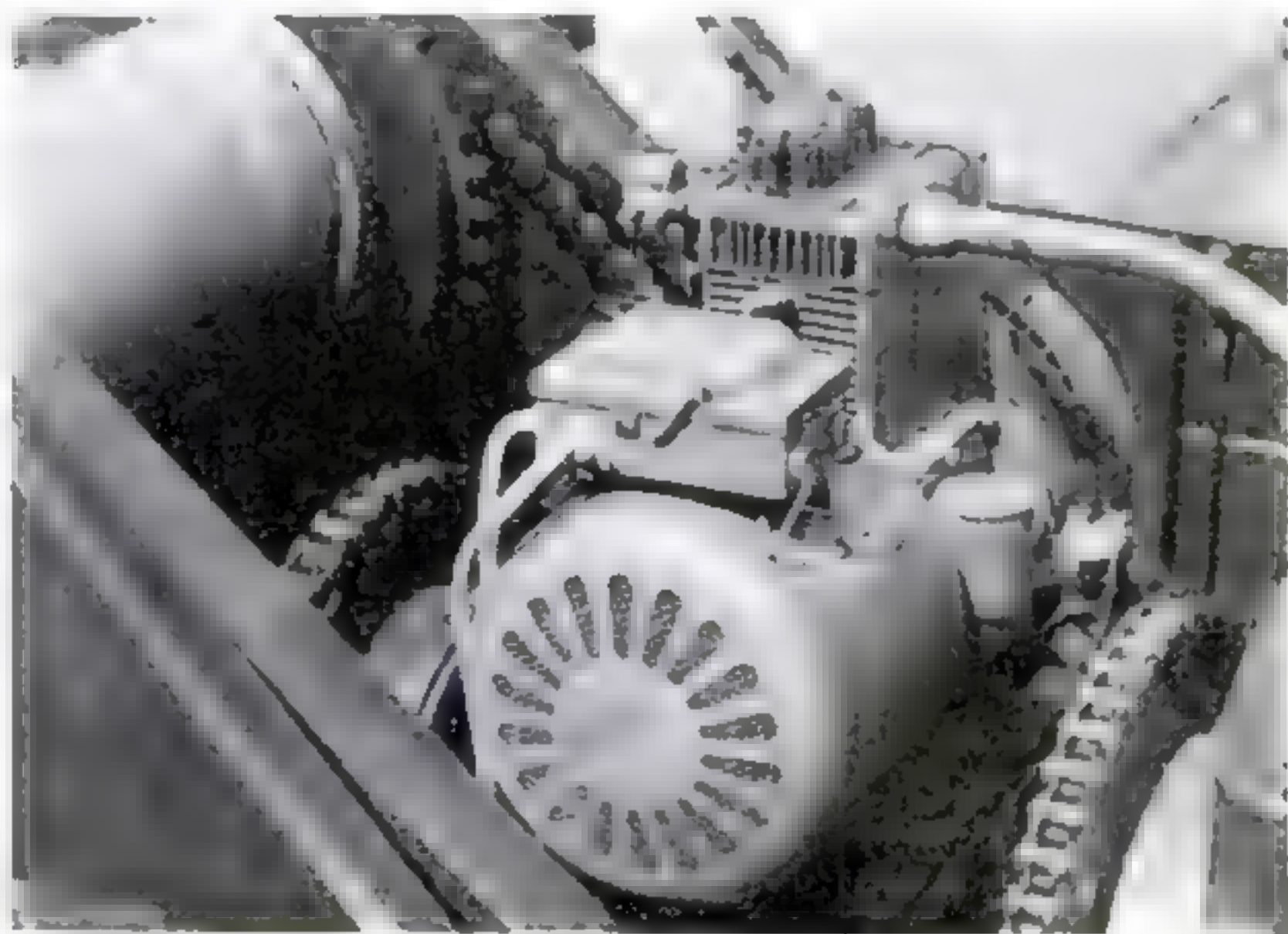
ACCURATE measurement of the length and width of the foot, the most important factors in fitting a new shoe, is made by a new T-shaped foot sizer designed for shoe-store use. Constructed of lightweight, plastic material, the instrument has a sliding central scale to measure the foot length, and a flexible tape mounted on a spring roller to determine the width. One side of the device is used to measure the right foot of a customer, and the other the left, the same scale and tape being used for each foot. The tape is protected with a special plastic varnish. The device is seen in use at the left.

Giant Wrecker Tows Big Trucks

WEIGHING more than ten ordinary automobiles, a wrecking truck recently built at a cost of \$15,000 by George C. Rubsch, of Los Angeles, Calif., can salvage and tow in the largest freight trucks and buses operating on western highways. Rolling on ten tires, the unit can haul a wrecked vehicle 3,000 feet up a hillside with its steel cable and winch, pick up a load weighing 75,000 pounds, and pump inflammable cargoes of fuel from the tanks of gasoline trucks which may have rolled off the highway. Receiving its orders

from headquarters by radio, the crew can live for several days on emergency rations stored in a running-board container. Anchored in place when engaged in lifting and pulling operations, the giant wrecker carries fire extinguishers, and powerful searchlights for night work. Recently, it picked up a heavily loaded truck and hauled the wreckage 200 miles into Los Angeles.

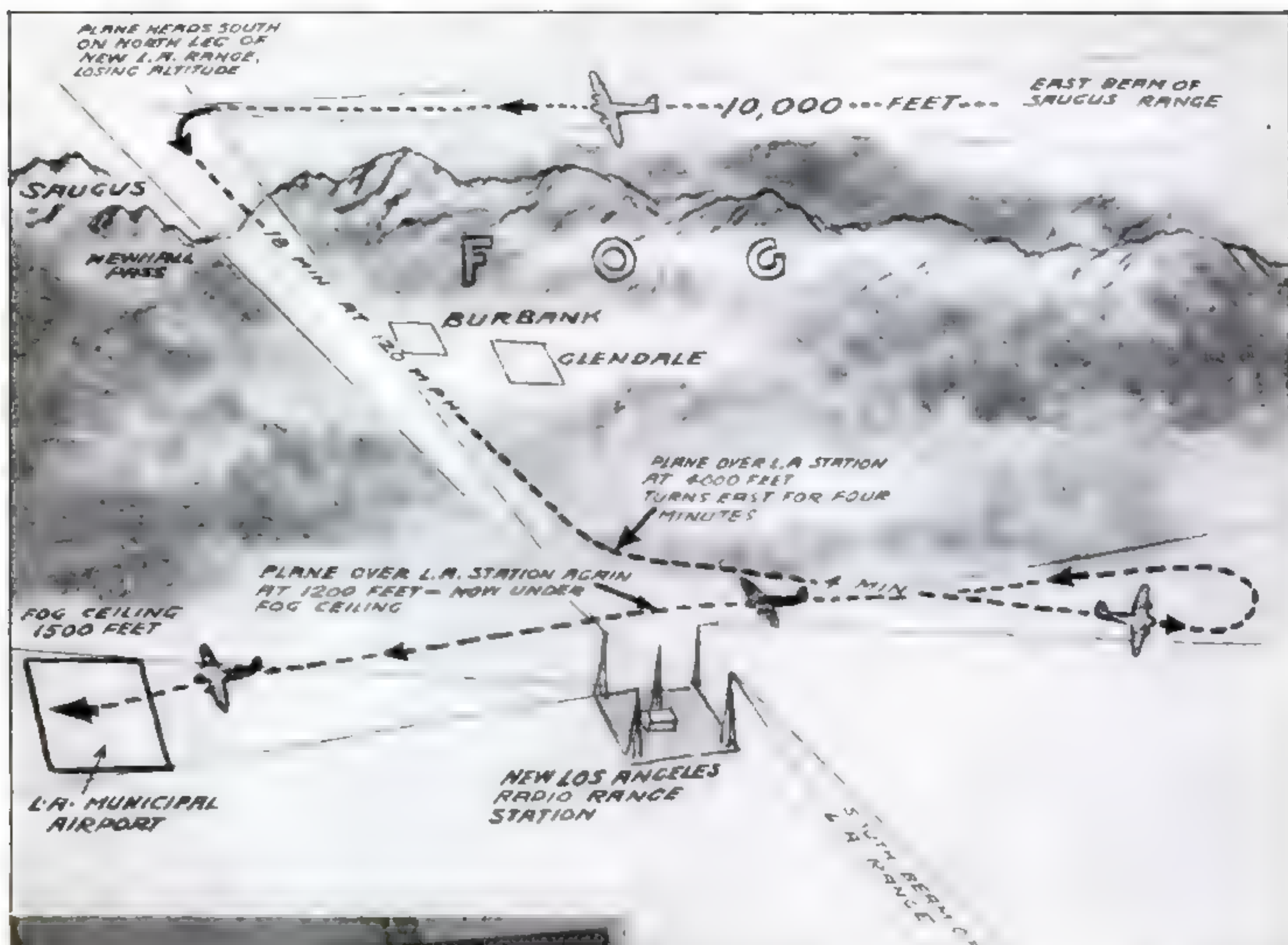
Equipped for any emergency, the huge wrecker below can lift 75,000 pounds with its crane



View of generator that powers lights, radio, and pumps for salvaging fluids from wrecked tank trucks



"Sky Railway" Guides West Coast Planes



Almost like riding tracks, Los Angeles-bound planes now follow radio beams sent out by the powerful transmitter shown above. The drawing depicts a ship being guided across fog-shrouded hills to safety

RISING 125 feet above a twelve-acre, fenced-in field on the outskirts of Los Angeles, Calif., five steel towers are providing trans-continental airway pilots with "fog eyes" for landing under adverse weather conditions. This new airway radio station enables a pilot, for the first time, to hear the radio-range signals and talk over the airway telephone system at once. Continuous signals pierce the sky to the north, east, south, and west of the new station. Each "leg" of the range is aimed strategically to help lead pilots through passes in the mountains or to guide them directly to the municipal landing field. The west leg of the range cuts knifelike across the runway of the airport. Pilots guiding thirteen-ton airliners through the sky on the westward run can now safely slide the great ships down into the Los Angeles basin even if fog hangs as low as 1,500 feet above the ground. Heading in on the northern leg of the range, the pilot flies eighteen minutes at 120 miles an hour. He passes over the radio station at 4,000 feet, cuts east for four minutes, makes a U turn and passes above the station again at 1,200 feet, out of the fog and heading straight for the airport runway.

Skin-Tone Analyzer Selects Right Color for Face Cosmetics

TO DETERMINE the exact cosmetic color that will best blend with individual skin tones, a novel analyzing apparatus has just been introduced for beauty-shop use. A complicated system of lenses, prisms, and a polarizing screen is used to throw a tiny rainbow of light onto the skin of a customer. Analysis of the basic color tone of the skin is then made by noting which shade of the spectrum is most absorbed and which is most reflected.



Studying a beauty-shop client's skin before prescribing a cosmetic

Hurdling Steer Takes Car in Stride

GALLOPING across the arena on the end of a stout cowboy rope, Silver Dollar, a prize full-grown white Brahma steer, provided spectators at a California rodeo with one of their greatest thrills as he took off into the

air with one tremendous leap and hurdled his half-ton weight over a parked automobile. This was no unrehearsed act, since the rare animal is one of the few trained Brahma steers in the world.



Not the beginning of a stampede. The rare white Brahma steer is simply going through his act at a rodeo



News from the



Movies Measure Brain Waves

"BRAIN-WAVE movies" are being studied in a laboratory at Harvard University, Cambridge, Mass. Scientists there are seeking a method of detecting the coming of epileptic seizures days and even weeks beforehand. Electrical impulses given off by the brain alter with the condition of the patient, Dr. F. A. Gibbs and A. M. Grass report. By determining exactly how much energy there is in single brain waves as recorded on motion-picture film, they hope to develop an exact method of diagnosing disturbances and to be able to note, at the very beginning, changes in brain-wave frequency which end in fits or seizures

Effect of Locality on Cancer

STATISTICS compiled by the U. S. Public Health Service indicate that environment and locality may play an active part in the occurrence of cancer. Both in number of cases and in the type of cancer found, there is great variety in the different parts of the country. Rhode Island, for example, in 1937 had nearly three times as many cancer cases for each 100,000 population as Arkansas had. States bordering the Great Lakes and those on the Pacific coast had a higher rate than that found for the country as a whole. Skin cancer is more prevalent in southern states than in northern states. In Atlanta, Ga., cancer of the lip was reported twice as frequently for white men and four times as frequently for white women as in Chicago, Ill. In the latter city, however, cancer of the digestive and of the respiratory systems was found to occur twice as frequently as it did in the southern city of Atlanta.

Tests Show Ages at Which Heads Grow the Fastest

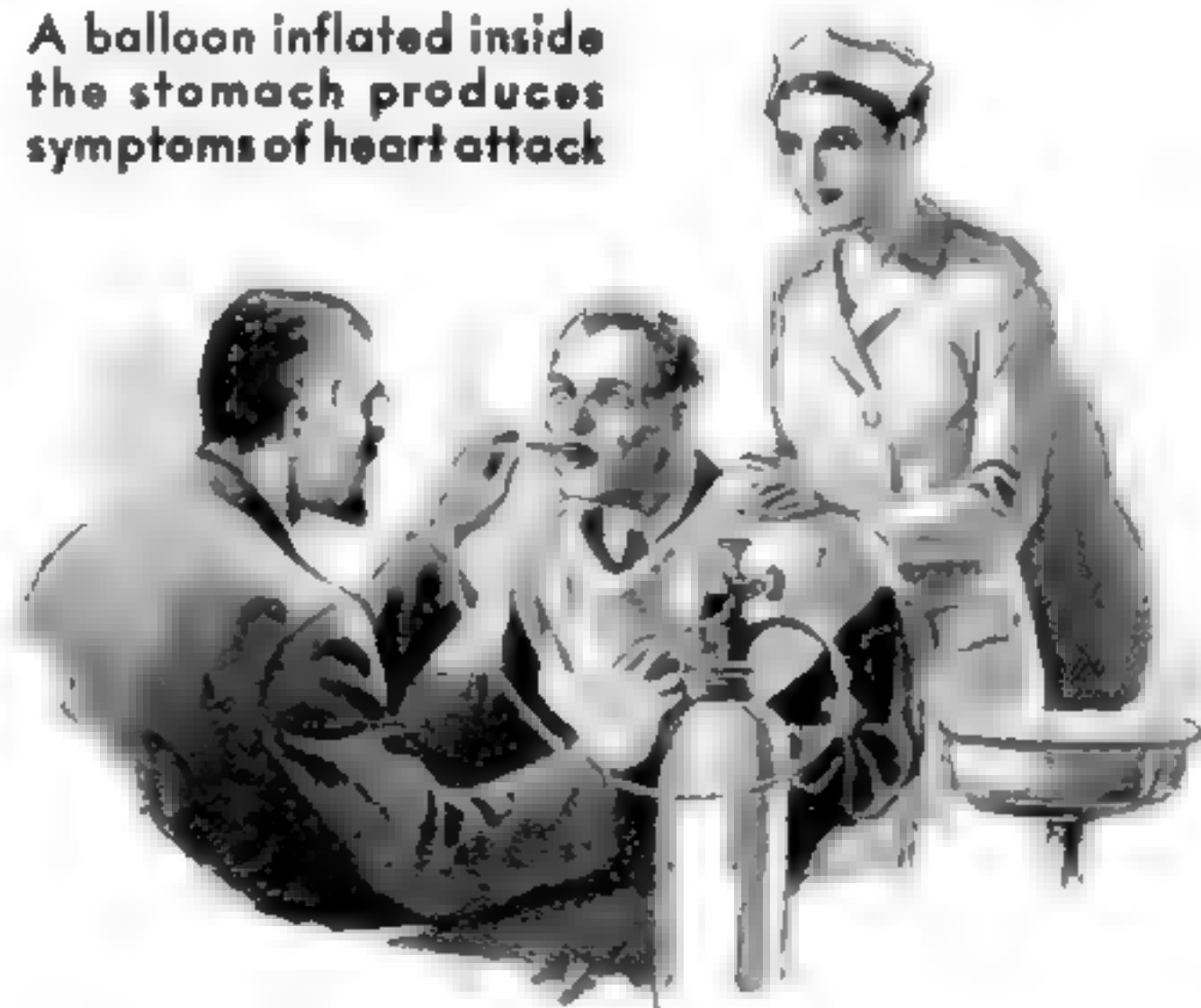


DR. MARCUS S. GOLDSTEIN, of New York University, New York City, after making measurements of more than 250 children, reports that the greatest head growth occurs between the ages of two and five. Increase in the length of the head drops off sharply from five to seven. At the age of thirteen, girls slow down in head growth, while boys take on a new spurt. Dr. Goldstein measured the heads of his subjects yearly until they were sixteen.

Balloons Bring Heart Attacks

BALLOONS, inflated within the stomachs of patients suffering from heart disease, have revealed valuable information about the relationship between the nerves of the digestive system and those of the heart. In a report to the American Medical Association, Drs. Lester M. Morrison and William A. Swalm, of Temple University, Philadelphia, Pa., explained how patients suffering from three different forms of heart disease experienced attacks as soon as the balloons were inflated, and found immediate relief when the gas bags were deflated. Many heart attacks, the scientists suggest as a result of the balloon and other tests, may be caused by a distention of the stomach resulting from eating gas-forming foods.

A balloon inflated inside the stomach produces symptoms of heart attack



HEARTBEATS, recorded on phonograph records and amplified by loudspeakers, form one of the latest aids to studying cardiac ailments. Specialists at the George Washington University Medical School, Washington, D. C., are using the "canned heartbeats" for teaching and research as well as for diagnosis in individual cases. When employed in instruction, the records can be played at will to show students how various ailments sound in the stethoscope.

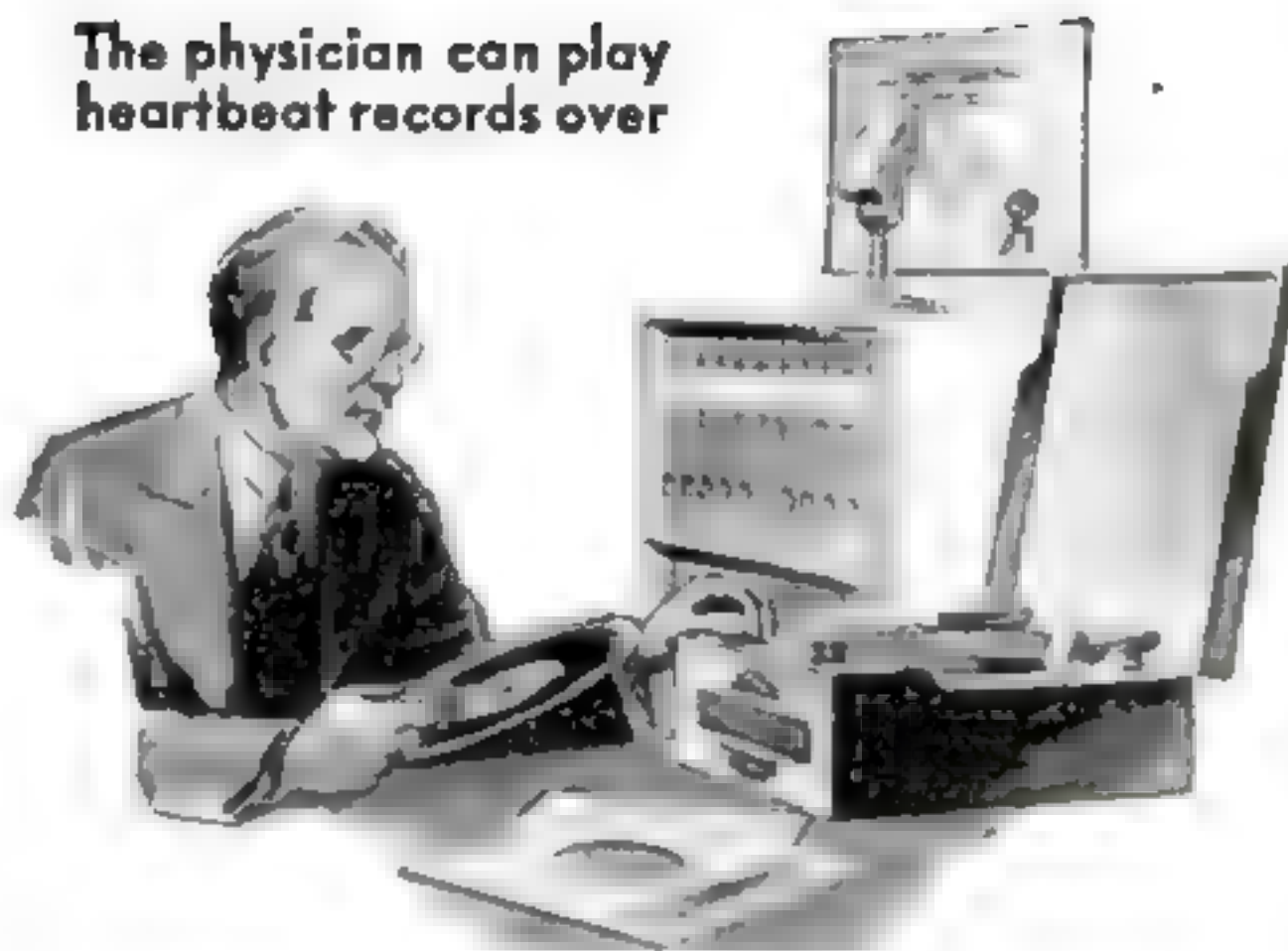


Swallowed before the throat closes, thread keeps a passage open

Thread Opens Burned Throat

SWALLOWING a twisted silken thread is recommended for patients who have had their throats burned by accidentally drinking caustic or acid fluids. The chemicals sear the inside of the esophagus, or tube leading from the pharynx to the stomach, and cause swelling which may close the tube and make it impossible for the sufferer to swallow food. Healing burns may leave scars that will seal up the passage. Having the patient swallow the silken thread before the esophagus has a chance to close, Dr. Porter P. Vinson, of Richmond, Va., reported recently, often aids in keeping the tube open during the early stages of recovery. Later, by means of long metal instruments, the tube can be stretched to provide a normal passage to the stomach. The thread is kept in the esophagus until the stretching treatment begins. Dr. Vinson told of one patient whose esophagus had apparently been closed for eight years, but who regained normal swallowing ability after receiving the thread treatment.

The physician can play heartbeat records over



AT THE famous Mayo Clinic, Rochester, Minn., spectacular success has been obtained by the use of a new-type gas mask for administering oxygen to patients. Only the nose is covered by the mask, which fits snugly in place and is not uncomfortable to wear. The patient can eat, drink, and talk without removing it. The increased efficiency of the new device makes it possible to administer oxygen at from five to eight dollars a day, instead of from twelve to twenty-five dollars a day, the cost of using an oxygen tent. It also is expected to enable physicians to use helium more generally for the treatment of asthma, as it avoids waste of the precious gas. At the clinic, patients seriously ill with rheumatic heart disease, lockjaw, gas gangrene, and shock resulting from surgery, have been aided in their fight for recovery by treatments with the new-type mask, which can also be used in private homes.

THE next time the doctor prescribes bitter medicine, rub ice on your tongue before you take it. Such is the surprising advice of Dr. Harold Tangl, of the University of Budapest, Hungary. The cold, he points out, will dull the 3,000 taste buds in the human tongue so they will fail to react to the medicine, which will have no more taste than would the same amount of water.



Fans Make High-Speed Photos AT WORLD'S FAIR

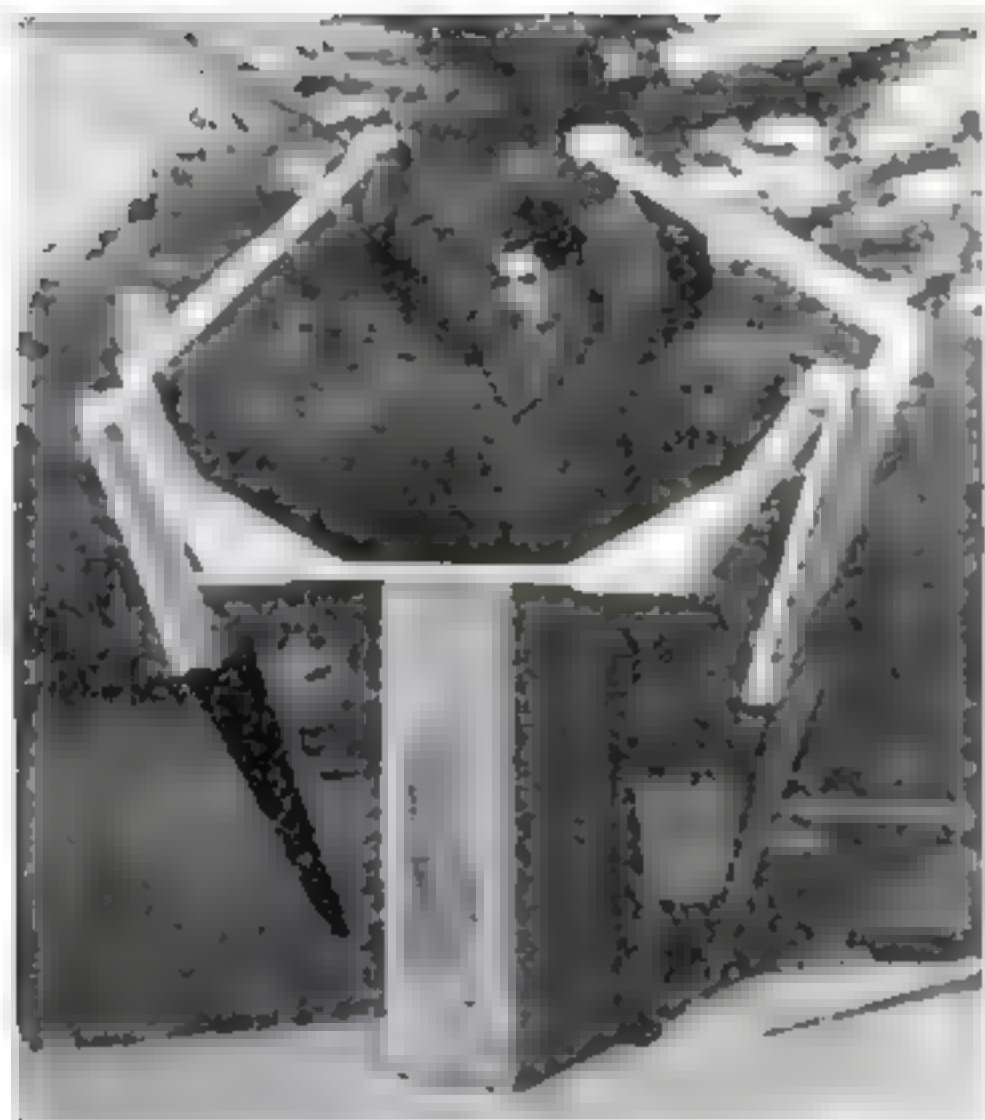


At this exhibit booth, amateur photographers can have the thrill of snapping a baseball as it smashes a glass plate into hundreds of pieces

CAMERA fans may have the thrill of taking their own stop-motion photographs, such as have been made famous by Prof. Harold Egerton of the Massachusetts Institute of Technology, at a high-speed photography exhibit sponsored by the Eastman Kodak Company at the New York World's Fair. Two fans at a time enter a booth and hold their camera lenses—stopped down to F/16 and focused at fifteen feet—against weak correcting lenses mounted in holes cut in the wall. The purpose of the correcting lenses is to shorten the effective focus of box-camera and other fixed-focus lenses. At a signal from the demonstrator, the fans open their lenses. In another moment, the demonstrator fires a spring cannon, which hurls a baseball through an eleven by fourteen-inch sheet of glass. As the glass flies into hundreds of pieces, two krypton-xenon flash bulbs flare up for $1/100,000$ of a second with an intensity 4,000 times as great as that of summer sunlight. At a second signal, the camera fans close their shutters again, the intense, swift light having caught on their film a picture of the speeding ball at the moment it struck and shattered the glass into countless pieces.



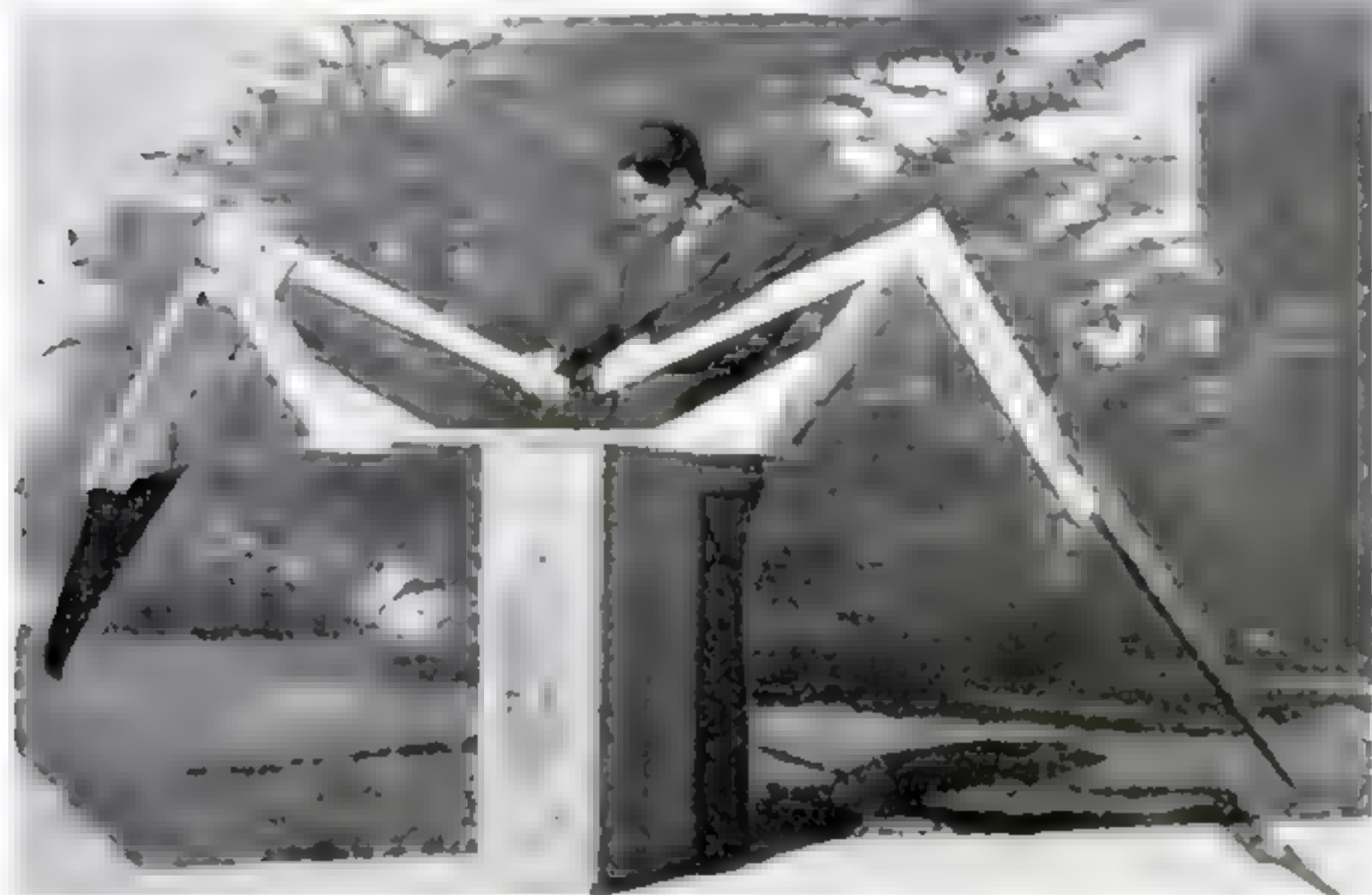
How fans make stop-motion pictures with their own cameras. At the right is a sample film record carried home by a visitor to the odd exhibit



Propelling mechanism for a rowboat



Arthur D. Hill, Jr., driving a canoe through the water at high speed with his strange device copied from a fish



Pumping the handles up and down is said to make a boat move three feet for every foot that the two paddles move



Hill's fishtail-drive model plane, powered by two flash-light dry cells

Fishtail Drive

PROPELS BOATS and MODEL PLANES

FOR ten years, Arthur D. Hill, Jr., a California commercial fisherman, has been observing and studying how the vibrating tails of fish enable them to dart through the water at great speeds. He also noted that birds, with their flapping wings, were still more efficient in flight than the most modern of airplanes with fixed wings. Puzzling out the principles involved, Hill determined to combine the methods of bird and fish, and he has finally developed an odd fishtail drive for propelling model airplanes, and boats ranging from toy craft up to vessels thirty-five feet in length. On tiny boats having a single rudder, Hill's fishtail mechanism is vibrated back and forth by means of an ordinary doorbell buzzer, powered by two dry-cell bat-

teries. By reversing the rudder, the flutterings cause the craft to move backward. Dry-cell batteries also power the vibrating wings of Hill's model airplane, shown in the photograph above. When suspended from the ceiling on a string, the little ship whirls around a circular course, its wings whirring so rapidly that they become invisible. For rowboat and canoe use, the inventor connects his fishtail propellers to handles, which the operator pumps up and down. This is said to drive the boat forward three feet for every foot the power device moves. On small toy boats and planes, such as shown in the accompanying illustrations, the fishtail drives are made of wood and silk, while for the larger craft airplane linen covered with creosote is used.

Wilburn Dowell Cobb displays the mammoth pearl placed as it was found in the shell of a giant clam



To the Mohammedan Dyaks, the nine-inch-long pearl resembled the face of Allah

By
EDWIN
TEALE

SOUTH SEAS ADVENTURER FINDS THE World's Largest Pearl

OPEN an atlas to a map of the South Seas and you will find Palawan, a long and slender island, stretching for nearly 300 miles down the western edge of the Sulu Sea. In one of its wild coves, some years ago, Dyak divers brought to the surface the world's largest pearl. Shaped roughly like a human brain and weighing nearly fourteen pounds, this valuable oddity

of natural history has just been brought to the United States by Wilburn Dowell Cobb, a South Seas trader and explorer.

The story of Cobb's adventures in obtaining the pearl and the record of its tragic and dramatic discovery form a tale such as Kipling or Conrad might have told. Palawan is still the home of wild tribes that hunt with poisoned arrows. King cobras, the most dead-



Crossed spears guard this Malay chief from the "evil eye" of the camera as he lets Cobb take his picture

ly snakes on earth, slide through its jungle vegetation. Malay pirates, distinguished by their red sarongs, prey upon boats from nearby, smaller islands. Only on Palawan grows the strange and deadly vine from which Dyak hunters obtain the poison for their arrows. Malay tribesmen from far and near come to the island to obtain the drug.

In the summer of 1934, Cobb set sail from Manila, in the Philippines, cruising south in a homemade sailing craft, trading for rattan and copra and exploring the wilder parts of Palawan as he went. Near Boligay, 450 miles south of Manila, he first heard the story of the giant pearl.

Several years before, half a dozen Dyaks had been diving for shellfish when one of the men failed to come to the surface. Investigation showed that a thing had happened which is continually dreaded in this part of the world. On the bottom of the bay, a giant clam, weighing more than 250 pounds, had clamped the two halves of its great shell on the foot of the unfortunate diver, holding him as though in a steel trap. In recovering the body, it was necessary to raise the clam to the surface. When the

natives broke open the shell on shore, they found inside it the gigantic pearl. The many convolutions on one side of its surface appeared to the Mohammedan Dyaks to represent the face of Allah. The prize became the property of Panglima Pisi, the most powerful chieftain of the region.

Three years later, Cobb made another voyage down the Palawan coast. At Boligay, he learned that Panglima's son was dying of malaria. Quinine, which was being used in an effort to save his life, was having little effect. In his ship's medicine cabinet Cobb had the malaria-conquering drug, Atabrine. He offered his services to the old chieftain, who gave him free rein in treating his son. The drug produced an almost miraculous change. In a few weeks, he was able to take daily salt-water swims with Cobb. When the patient had recovered completely, Cobb boarded his vessel to sail away. Just before he left, Panglima called him aside and told him he had vowed to give him the most valuable thing he owned, the great pearl, if he was successful in curing his son.

So, when Cobb returned to Manila in the fall of 1937, he brought with him the hugest pearl known to science. Since its recent arrival in the United States, it has attracted an ever-increasing amount of scientific interest in various circles. *(Continued on page 228)*



Here the explorer is shown with a group of the Dyaks who found the giant pearl. He shaved his head to protect himself against pigeon lice



You're Right! It's All Done with Mirrors

USING two circular mirrors facing each other at a distance of four feet, Harold A. Soard, an amateur photographer, of Oklahoma City, Okla., produced the arresting camera shot shown above. The mirrors multiplied the image an indefinite number of times and produced the tunnel effect, tapering into the distance, which has been caught in the photograph. The camera was stationed slightly to one side so its reflection did not appear in the picture.

Goal Ahead

By BERTON BRALEY

*Those who "go places"
Know places to go,
Whether their pace is
Swift-footed or slow.
They are not haunted
By doubtings, but they
Travel, undaunted,
Their confident way.*

*No one will wind up
Successfully, who
Can't make his mind up
On what he would do;
Fix your selection
Of goals in your nut,
Go that direction
And nowhere else but!*

*Vim, vigor, vision,
Brains, brilliance, and such,
Lacking decision
Won't get a man much;
Don't shilly-shally
But know what you're at,
Pick your own alley
And bowl 'em down that!*

*Few men, if any,
Get far when their stunt's
Traveling many
Directions at once;
Choose your route—take it
Straight through to the end.
Sure, you can make it,
And—luck to you, friend!*





Monk Cavorts to Radio Swing

TURNING a crank for ten or twelve hours a day got to be too much like work for Carmen Armenti, a Cleveland, Ohio, organ grinder. So now he walks his rounds with his pet monkey and a portable, battery-operated radio mounted on a stick rest and hung on a strap slung around his neck. Flipping a switch, Armenti says, is easier than pumping that hand crank.



Rubber pads on the metal bar press against the tub

Mechanical Fingers Tie Up Packages

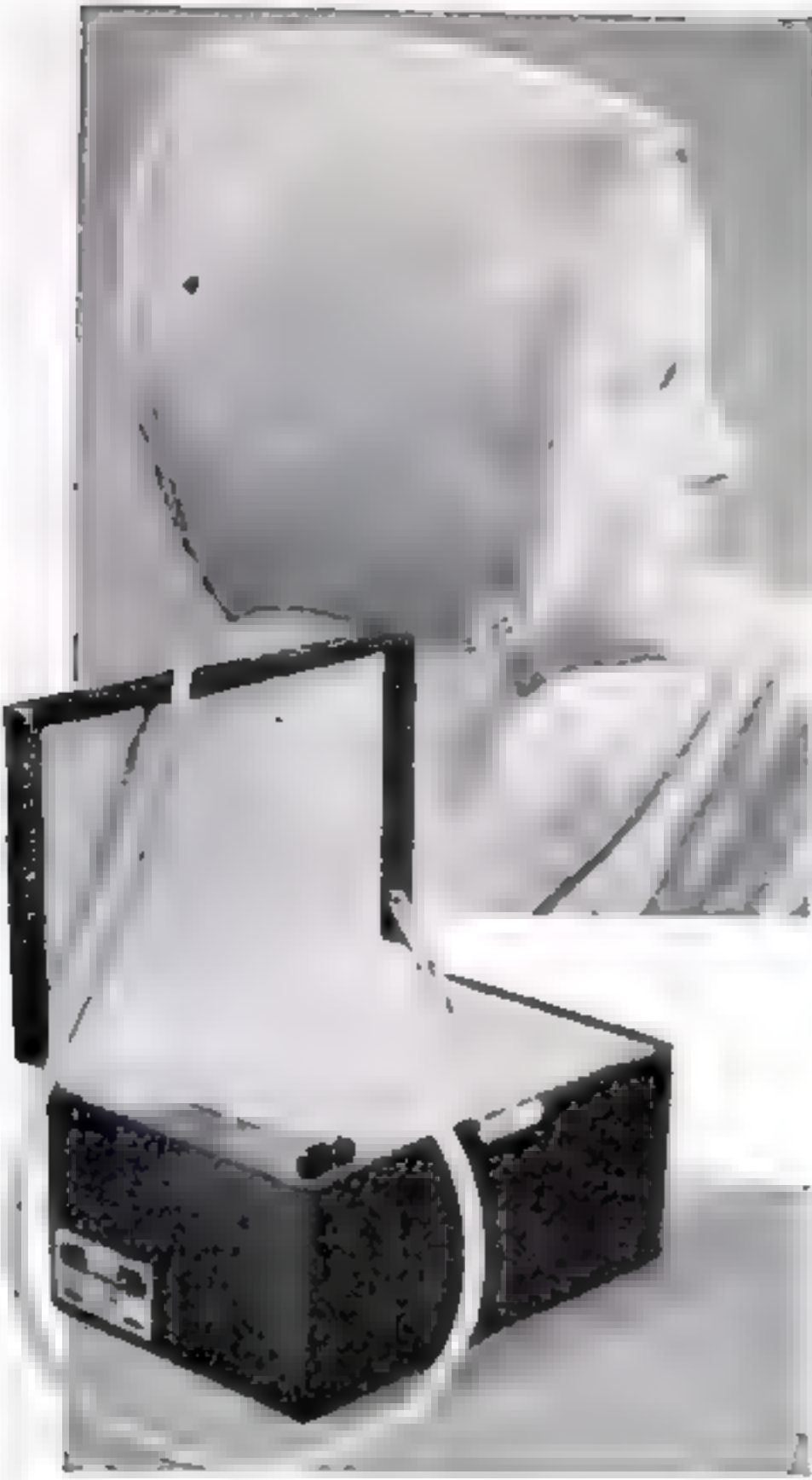
FROM twenty-five to thirty-five packages can be tied with string within one minute by a novel machine recently introduced. A dream come true for wrapping-counter clerks, the apparatus handles packages of various sizes without danger of breakage, and finishes the operation with a firm knot. In use, the machine works so fast that it is almost impossible for the eye to follow its movements. It is pictured about to tie two boxes together.



Binding two boxes together with the tying machine. It finishes up with a firm knot

Safety Belt Moors Baby in the Bathtub

IT'S dangerous to leave a small baby unattended in the bathtub, and yet, when the telephone rings or the doorbell must be answered, it is sometimes inconvenient not to be able to do so. Carl H. Fischer, a Council Bluffs, Iowa, engineer and father of three youngsters, solved this problem with the ingenious device pictured at the left. The baby is strapped in a harness that is attached to a metal bar. When the bar is turned, rubber pads threaded to the ends press tightly against the sides of the tub and hold the safety bar firmly in place.

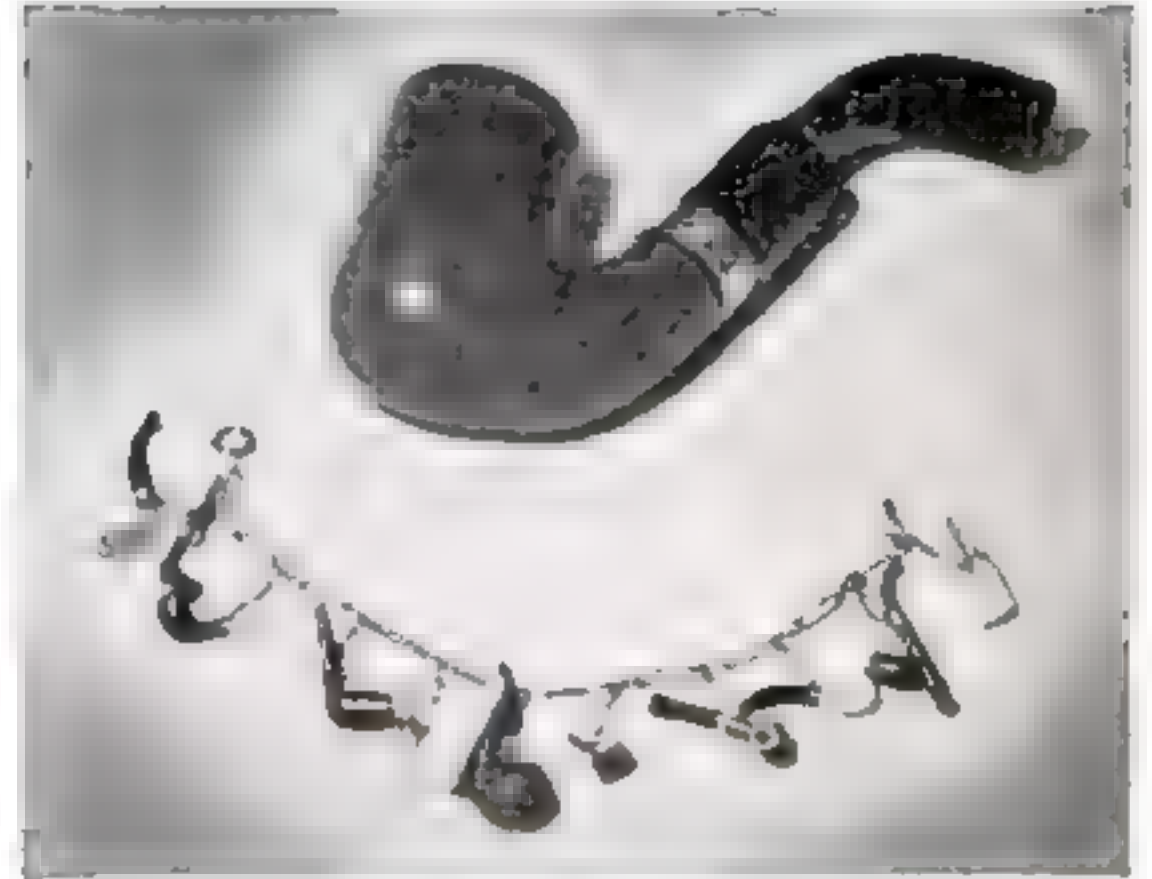


Electric Cap Treats Hair and Scalp

TO STIMULATE scalp circulation and beautify the hair, an electrically heated cap is now available. A cream embodying ingredients said to be similar to those present in normal skin is applied to the scalp and then "baked in" by the cap's heating element at slightly higher than body temperature.

Tiny Pipes Form Unusual Bracelet

MADE UP of a group of miniature smoking pipes, comparable to conventional pipes in every detail except size, a "charm bracelet" owned by a New York tobacconist is pictured in the photograph at the right in comparison with a standard-sized pipe made of a special wood and valued at \$100.



Hobbyists Collect 3,000 Rope Knots

MORE than 3,000 knots and other items of ropework, of almost every conceivable variety, are included in a remarkable rope collection made by Raoul Graumont, a French seaman, and John Hensel, a Danish-American sailor. Said to be the largest collection of its kind in the world, the specimens include fancy ropework of almost unbelievable intricacy, made by sailors on long ocean voy-

ages. Graumont started his collection as a boy sailor twenty-five years ago, and combined it not long ago with the specimens collected by Hensel, whom he met when the latter signed on Graumont's ship at Alexandria, Egypt. The collectors themselves are ropework creators, running up in only one week such painstaking items as a lady's rope handbag that contains 35,000 knots.



Raoul Graumont peers through a ropework picture frame he made. At right, he and John Hensel are shown beside their knot display



You CAN Teach

A Famous Trainer Tells You How To Educate
Your Pet for Obedience and for Protection

By ERNST RETZLAFF



In training a dog to walk at heel, use the left hand as a guide while working the leash with the right. This keeps the dog from becoming hand-shy. At right, teaching him to sit down on command



THESE dogs," the owner said apologetically, "are seventeen years old. I don't suppose you can do anything with them." I examined her Irish setters and played with them a few minutes on my training field at Van Nuys, Calif. "They seem in good health and high spirits," I told her, "and I'm sure their age will not prevent them from learning." Two months later, the setters were following obedience commands and performing a few simple tricks of which their mistress had thought them wholly incapable.

In twelve years I have trained more than 500 dogs, some for obedience and protection, others to take intricate parts in motion pictures. No two were alike, yet all have been able to learn new tricks regardless of age. Two important facts must be remembered,

however: dogs should be handled as individuals, and their training must be conducted in logical sequence, each step being woven into the preceding one exactly as you would forge links in a chain.

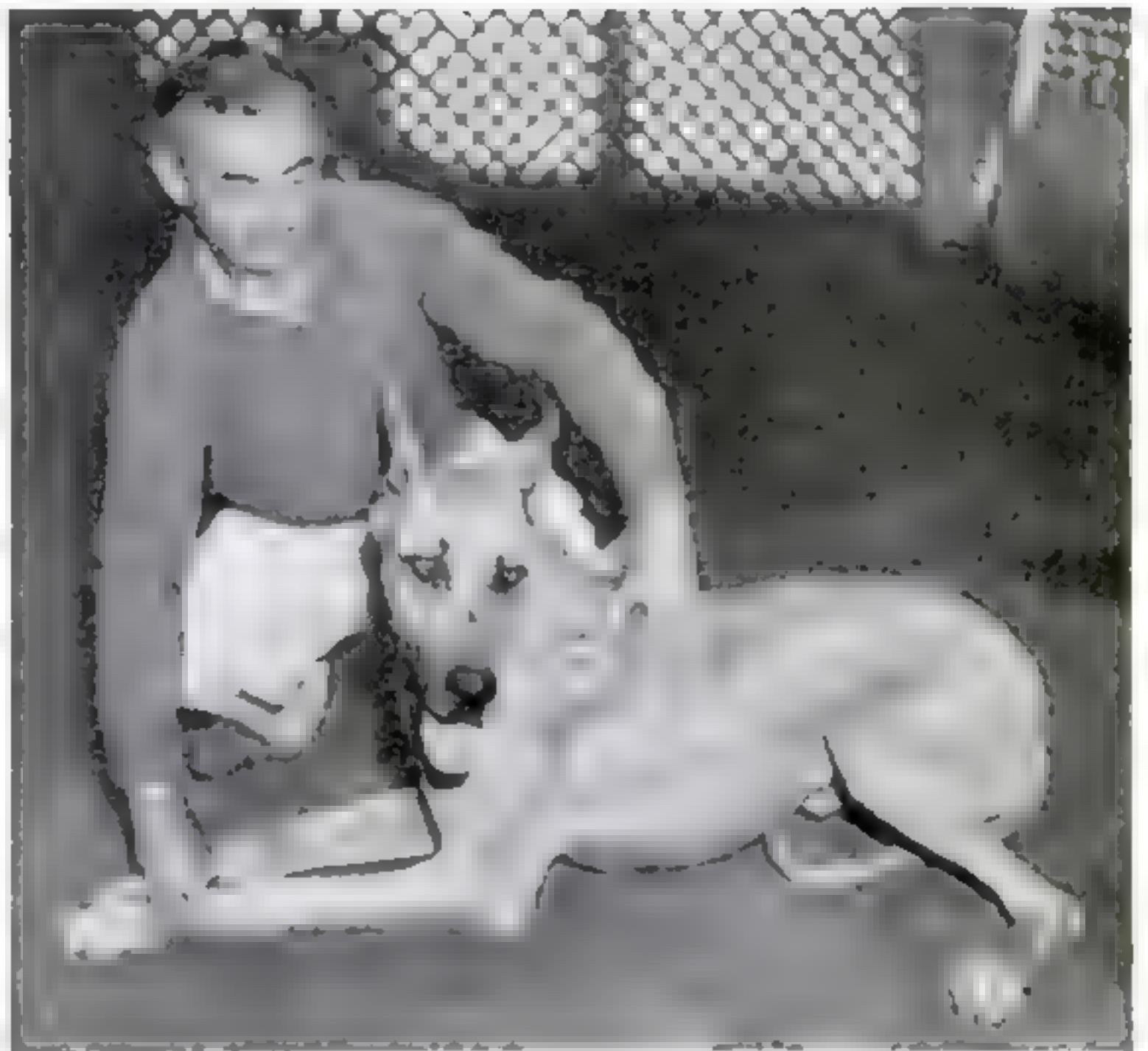
Any dog may be taught obedience. Those possessing natural ability for fighting can learn to protect the home and their owners. These include the working breeds, as the great Dane, St. Bernard, giant schnauzer, shepherd, Doberman Pinscher, collie, and Airedale. The English bull, while a great fighting dog, never lets go once his teeth fasten into flesh and thereby becomes easy prey for a knife or gun. All these become proficient climbers and

an Old Dog New Tricks

jumpers, important attributes in any dog kept for protection.

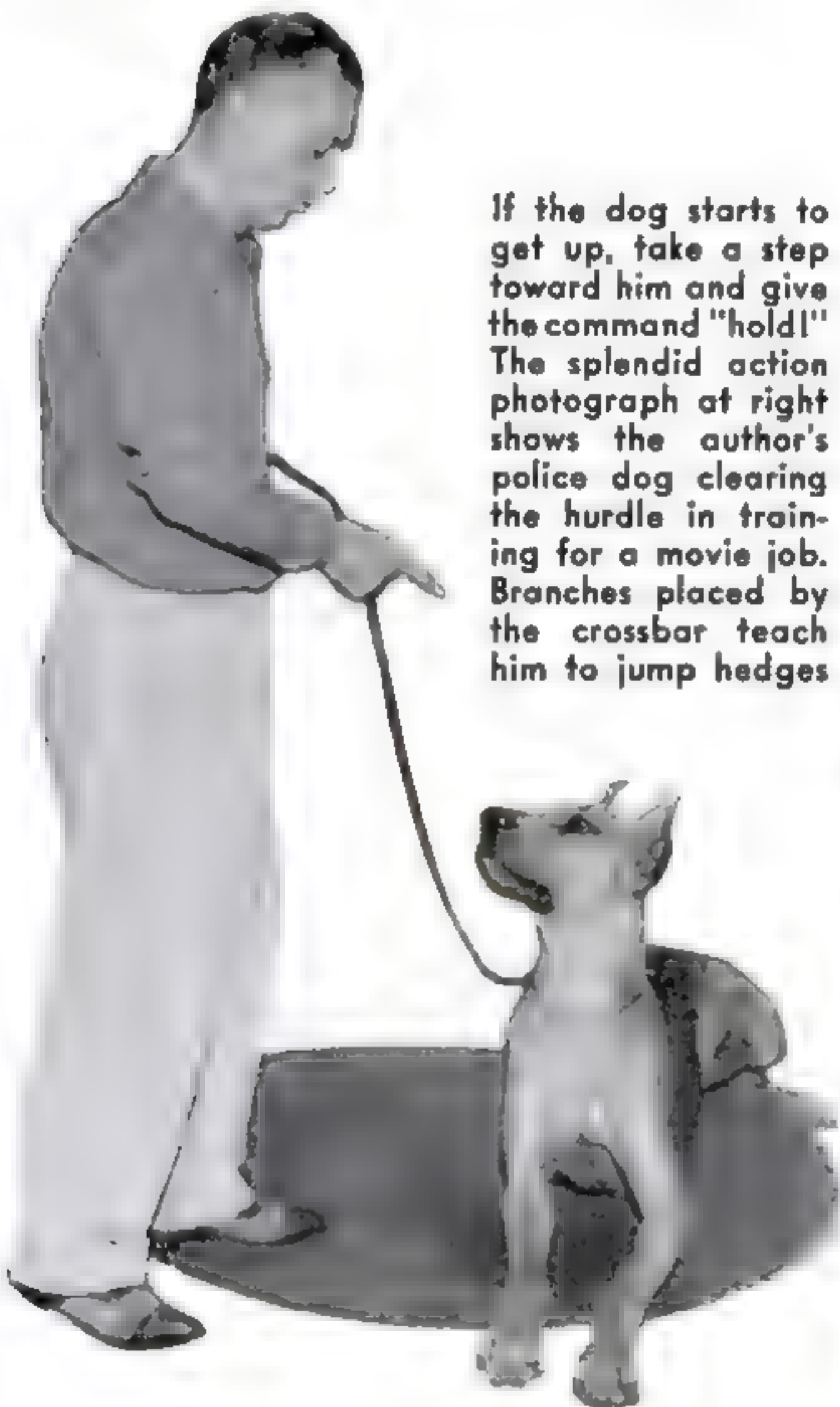
From the beginning, require strict obedience. You may have to shout at your dog, or he may respond to a whisper. I have known dogs to become cowards when addressed for a while in loud tones. Your dog always should walk at heel, on the left side, because the average person wields a weapon with his right hand, and in case of attack the animal can leap directly at the right arm and hand without crossing between your adversary and you.

It is better to start the work indoors, to avoid distractions. Lead the dog around the room, never permitting him to move ahead of the knee nor drop behind the heel. Hold the left hand alongside the trouser leg, using it as a guide for the leash, which will be worked by the right. Thus the dog does not associate pressure on the collar with hand movements. I have known dogs to become hand-shy, much as many of them are known to become gun-shy.



To show him what "lie down" means, place your left hand on his back, pull out his front feet, and push him down

When the dog ceases to pull on the lead and begins to follow correctly as you turn, teach him to sit. Stand the dog on your left, hold the leash in the right hand, place the left hand immediately forward of the hips and, while holding the collar up, press the fingers in and the hand down. Always give the command, "sit," as you apply



If the dog starts to get up, take a step toward him and give the command "hold!" The splendid action photograph at right shows the author's police dog clearing the hurdle in training for a movie job. Branches placed by the crossbar teach him to jump hedges





For training in wall-jumping, start with a low barrier and gradually increase the height. When the wall gets too high for jumping, the dog will pull himself over as shown above

the gentle pressure to his back.

Make sure the dog remains seated when friends approach, for they never appreciate a "jumper." Shortly you will find him sitting without command whenever you stop walking. If the dog tends to leap at visitors, when you halt with him at heel bring the right foot back of your left leg and press down on his back. Use the side, not the toe, for the object is to surprise and not to injure him.

To teach a dog to lie down, bring him to the sitting position and lay your left hand over his back directly ahead of the saddle. Pull out the front feet with the right hand and press down with the left, repeating "lie down" several times during the action. When your dog understands the meaning of "lie down," you may teach him to remain in place for indefinite periods. Have him lie down, then take two steps backward, and as you repeat the command, walk backward in an ever-widening circle until at last you are moving in a complete twenty-foot circle around the dog. If he arises, take a step or two toward the dog and emphasize the command. Repeat this performance until you disappear from his view. When sitting, the dog should be alert for your return. While lying he should relax.

The obedience course completed, put your dog "over the jumps." Start with a crossbar two feet high. First, step across the bar yourself. The dog will follow. Then stand aside, and lead him over. He'll try to walk across, but, finding the bar slides uncomfortably down his chest, thereafter will jump.

This cocker spaniel is getting a lesson in climbing a ladder. After he has mastered a simple climb, the ladder is shaken to give him confidence in mounting structures that are not firm



Gradually raise the jump at six-inch intervals, calling him over as you stand alongside.

After a few rehearsals, lower the bar, remove the leash, and the dog will jump when called. From here move to the wall jump if you wish, starting low and adding boards. When the wall's height passes the dog's ability to leap upward, he will run up the side, grasp the upper edge with his paws, and pull himself over. Now he's beginning to learn wall-scaling.

Climbing ladders should be included in the training of any protective dog. Not solid ladders, but those which tremble and shake. For this purpose, it is a good plan to construct a small platform, with six-foot ladders leading up and down on two sides. Coax the dog up, permit him to rest on the platform, lead him down. Thus he acquires confidence. After a few trials, shake the platform gently, then vigorously, as he climbs and descends.

A dog so taught will protect your home, but what about safeguarding your person? One final step, and he will be ready.

Tie the dog to a chain, preferably in a corner. Tease him with a sack until he grabs it. Let him pull it from your hand, so he will think he has won the battle. As he tugs again and again, threaten him with a stick. Now wrap the sack around your right hand and arm, making sure the flesh is adequately protected, but keep the sack loose so the dog will grasp only its folds. Push your arm into his mouth as he growls, permitting him to pull briefly.

When he becomes quite confident of his fighting ability, remove the chain and tie the



Sonny, the author's police dog, rests between jumps

dog to a leash, which you hold as an assistant "rushes" you. At first, the attacker backs away when the dog resents his appearance. Finally, the dog and his prey close in, the latter waving his stick as the dog grasps his protected arm.

At the height of the dog's excitement, call him off, pulling the leash at the same time. Unless he responds, slowly at first and later instantly, he has not been trained thoroughly in fundamental obedience. Eventually, however, the dog will defend you against all comers if danger threatens, but will drop that defense the instant you call him off.



Protection training teaches the dog to battle intruders. At the start, chain him in a corner and let him tug at a sack held in your hand while you threaten him with a stick. Later, wrap the sack around your arm

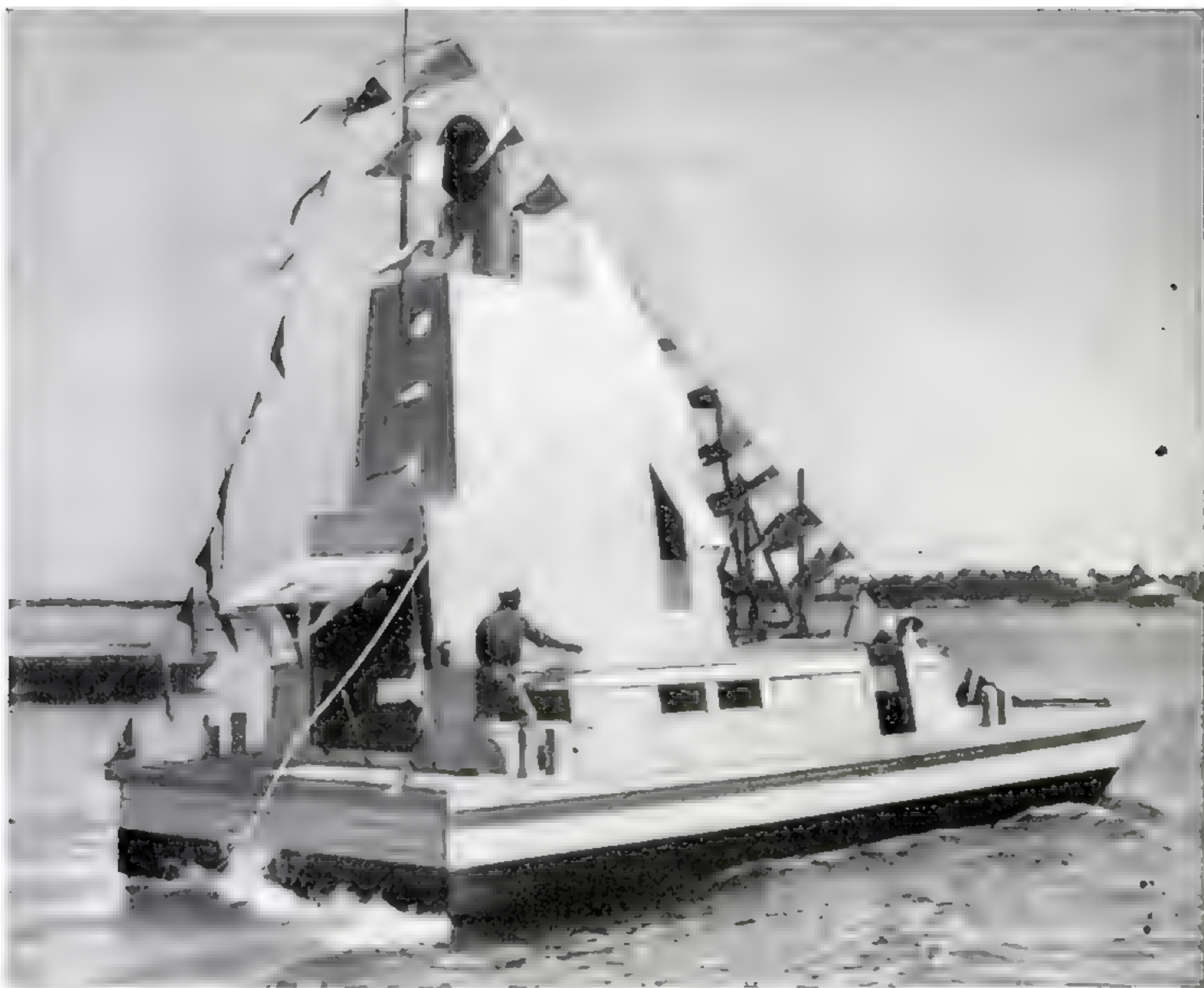


Ready to row places and shoo things—aside! A young couple test out a new exerciser: a mobile whirligig rowing machine

Novel Rowing Car Provides Good Sport

WHAT this country needs is an exercising machine that will provide good sport as well as build up muscles and tear down excess avoirdupois. At least that is the belief of the New York manufacturer of the novel whirligig car shown above. Circular in shape, the two-passenger vehicle is provided with oar-like handles connected by gears to the car's wheels. By rowing, the car can be propelled

either forward or backward, and the power required to move it may be varied to make the exercise more or less strenuous. Because the exerciser may spin off a straight course if the two rowers do not pull evenly on their respective oars, the car which is of particularly sturdy construction, is provided with an encircling rubber safety bumper to cushion any minor collisions.



Undersea Explorers Build Odd Barge

OVER forty feet long, a curious barge recently launched in Nassau, in the Bahama Islands, will carry a long flexible submarine tube down which cameramen and scientists will descend to a glass-windowed metal

sphere where they will photograph and study undersea life. Built for J. E. Williamson, noted underocean explorer, the barge hauls the tube and sphere along through the depths as its motors propel the craft.



Flipping the pages gives the moving-picture effect

Moving Pictures in Books Teach Athletes Technique

PICTORIAL as well as written explanations of the fine points of various track sports are graphically presented in a series of novel picture books recently published. In the volume covering the technique of the pole vault, for example, photographs reproduced on the right-hand side of each right-hand page give the student a moving picture of a champion vaulter in action as the pages are flipped with the thumb. The text printed alongside of the photographs analyzes each phase of the vault, and provides hints on technique, training, equipment, exercises, and other important factors in learning how to become an expert.



A scene in Blochman City. Boys and girls built the ten buildings and laid the six streets of the "town"

Country School Students Run MODEL CITY

WHEN the student citizens of Blochman City, Calif., reach maturity, they already will have received through practical, everyday experience a working knowledge of banking, storekeeping, public health, law enforcement, modern housing, tax assessing and collecting, museum management, and—last but scarcely unimportant—street cleaning.

Blochman City, perched on a hillside in Cat Canyon, fifteen miles by a winding road from Santa Maria, represents a project started eight years ago by Mrs. Bina L. Fuller, principal of an unusual country school.

In this period, the model town has evolved as a complete entity embracing ten buildings, from florist shop to city hall, and wide streets, all laid out and constructed by the children. The city represents Mrs. Fuller's idea of "practical education" by which the pupils of Blochman School learn each year something of the problems they will face as grown-ups.



The model city pays its workers in stage money. At the bank they can keep checking accounts and obtain loans

The city organization and the chamber of commerce are the school's principal activities. Mayor and council, elected by popular vote, oversee all city work and the chamber of commerce conducts the projects. Everybody receives a salary, depending upon the work and responsibility. Tax assessor and collector receive \$100 annually, the mayor \$500. Pay day comes once a month. Money collected by the children may be stage money to you and me, but it purchases lots, buildings, and stocks of goods for them. One may acquire property individually or jointly with

his friends, buy and sell at will. Each property owner pays taxes, may borrow at the bank, renew the note provided interest payments are met. Each lot owner must pay two dollars monthly for water.

For fifteen years Mrs. Fuller has been teaching Cat Canyon youngsters the dangers of climbing near-by oil derricks and the advantages of book learning. Early she became convinced that rule-of-thumb instructional methods could be vastly improved. "One project, directed by the children and embracing mathematics, history, English, civics,

A Novel Experiment in Education Prepares Growing Boys and Girls for Modern Life and Citizenship

By JOHN E. LODGE



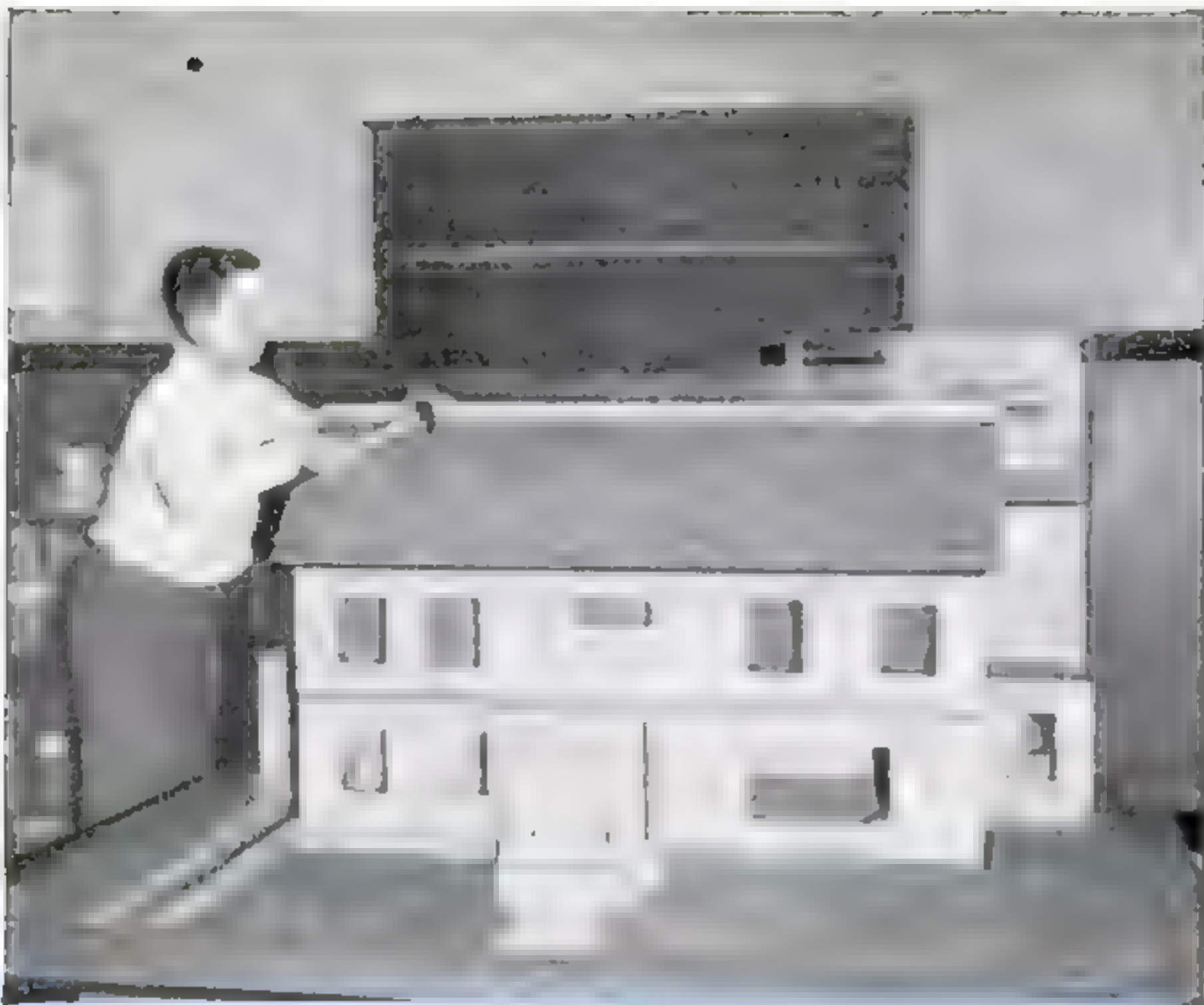
Every morning, before tackling their problems in economics and government, "citizens" salute the flag



This model sawmill was built by the boys in a study of wood, and has been exhibited at several fairs in the West



History comes to life in the relics gathered in the town museum at left. Like all other buildings in the model city, it was constructed by the students in odd hours after school



In their study of housing, pupils built this model of a modern home. They are now furnishing it with miniature fixtures



The story of transportation was first learned from pictures. Then the boys got a model-railway system

and sociology is worth more than a thousand recitations," was the way she reasoned. Slowly the project method evolved in her mind, and one day she sprang the idea of a city on the youngsters.

Scarcely had she dropped the hint before the idea was gathering momentum. "We cannot take the children to the city," she told neighbors, "but we should bring the city here and give them some idea of what they will face when they start to work." During a summer vacation Mrs. Fuller laid the scheme before John Williamson, president of the Palmer Stendel Oil Corporation, which owns the property on which Blochman school is located. "They can have all the land they need," he promised.

Before Williamson could change his mind, the boys were helping survey a plot containing 20,000 square feet, and when school started in the autumn they were spreading gravel, laying out twenty-four small lots, grading six streets, and hammering nails into the studs and beams of the first building.

A contractor showed them how to lay mudsills and erect the frames. Thereafter the boys took care of major construction, the girls nailing on siding. Following completion of the single-room city hall, up went the real-estate office, museum, hospital, model home, bank, store, florist



A closed meeting of the city council discusses the grave problems of municipal administration

shop, and, finally, their own health center.

Business men in Santa Maria and in Santa Barbara, seventy miles distant, heard of the project. One volunteered a quantity of wall board. This gave Leonard Calderon an idea.

"If people send us things, and we tell our parents about them—well, that's advertising, isn't it?" he asked Mrs. Fuller.

"Certainly," she agreed.

Next day five letters, scrawled in the uncertain penmanship of sixth and seventh-graders went out on the noon mail. Three of the requests bore fruit within a week, when sixty sacks of cement were delivered by three building-supply establishments to the little country school. That cement shortly supplied curbs for the streets, and enough is yet stored under a table to keep them in repair for several years. Those successful letters were among the first of hundreds so convincing that only once in the intervening years has a manufacturer turned thumbs down to a request.

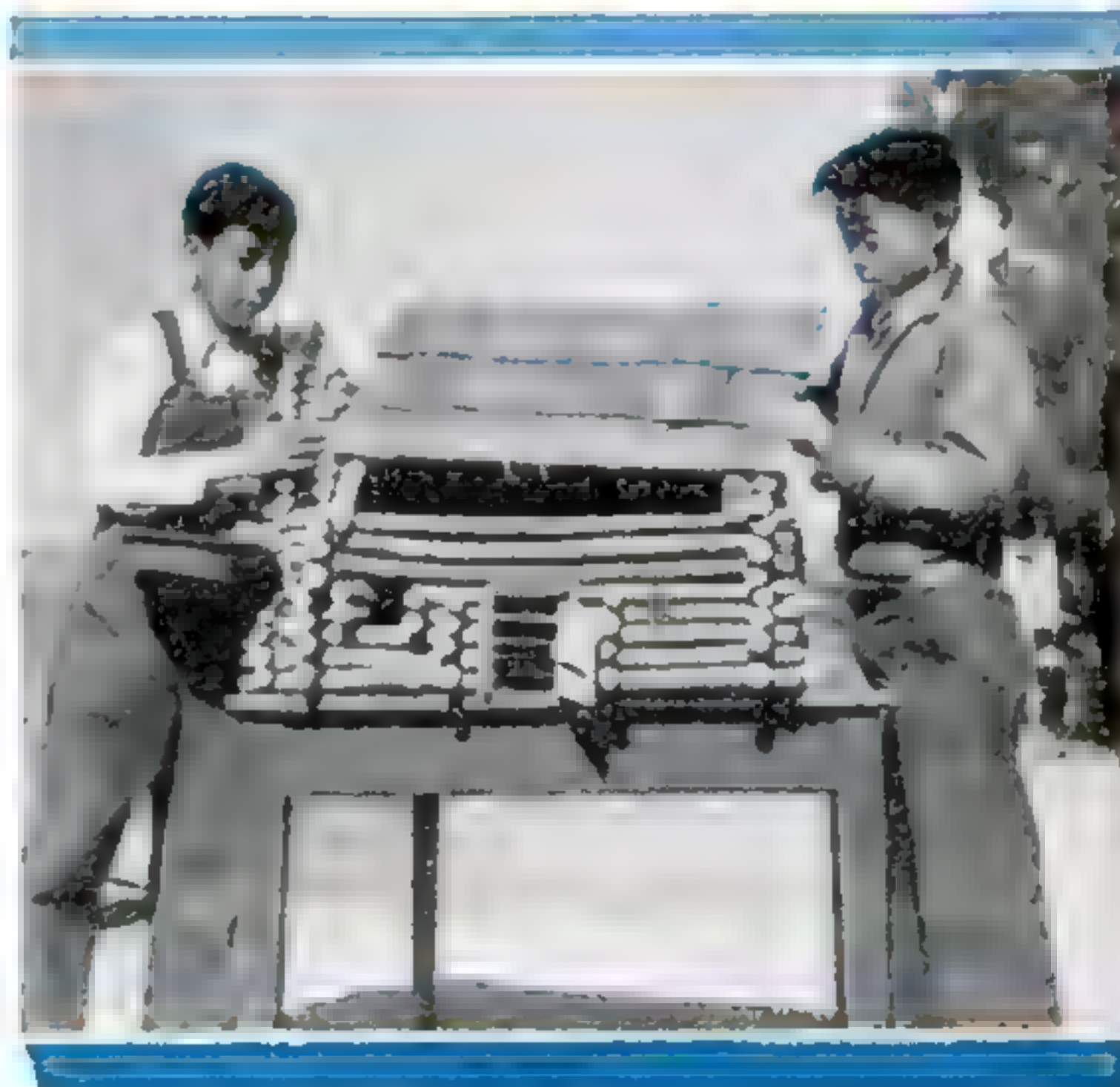
When I suggested a tour of the city that I might inspect the buildings, Mrs. Fuller introduced me to the president of the Blochman City Chamber of Commerce, Miss Jeanne Wilson, now twelve and a seventh-grader.

Jeanne led the way downhill to the city with a self-assurance lacking in many older persons of my acquaintance. In the museum she showed me clay pipes from America's first English settlement at Jamestown, Va., and a rock recently received from St. Augustine, Fla., the

first white settlement. We popped into the city hall, where I glanced through the mayor's files; into the store, stocked with scores of items gathered from the four corners of the nation; into the health center, where Nurse Norma Stevenson gives first aid; the florist shop, fragrant with begonias and trailing vines; the bank, whose wares are made available by the cashier and teller to those maintaining sound credit.

While I was at the bank, John Tarter came up to whack a slice off his loan. "What did you borrow this money for?" I asked. John gave me a little lesson in economics: "When you want to buy a lot, house, or building, and you need money, you come to the bank for it. George Burger and I bought the Bureau of Information January 5, 1938, for \$2,000. George paid \$1,000, and I put up \$1,000. But I didn't have that much, so I borrowed \$500. I still have four months to pay up my note. I'm sure the bank will renew it, because I always pay my debts. Then George and I can improve the building and sell it next year for more than we paid. You know, the more you improve your property, the more you get for it."

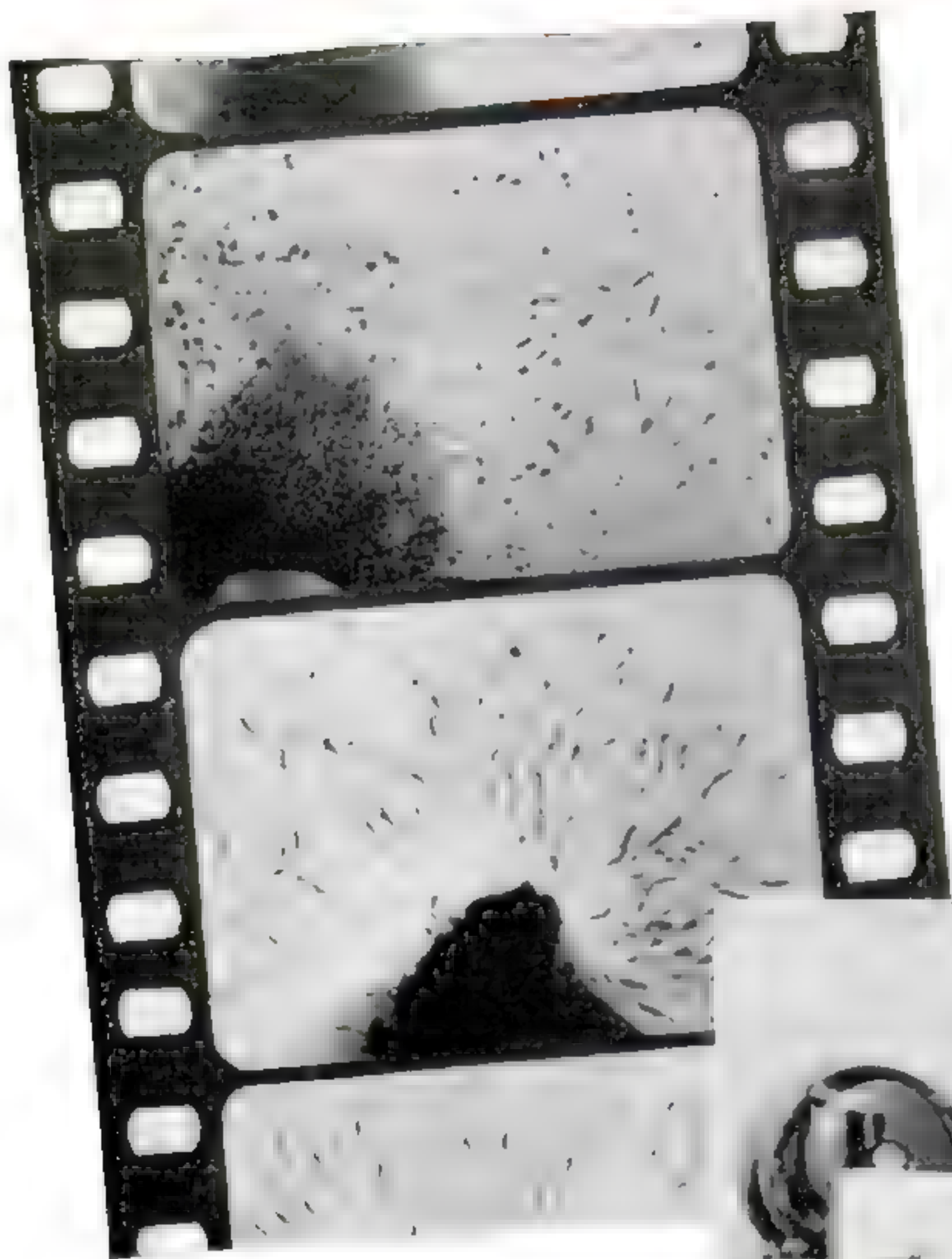
Mayor Janice Sturgeon, also of the seventh grade, and Jeanne are proprietors of the general store. All items on their shelves are contributed by "advertisers." On certain days they stand behind *(Continued on page 226)*



This log-cabin model represents an early stage in the evolution of housing. Its construction followed that of a model teepee

After a visit to a near-by oil field in which they studied the wells at first hand, the boys built this working model of a derrick, complete in every detail

Microbe Movies Help



Cancer growth spreading in tissue, as filmed in action through the microscope. At the right is the mechanism that snaps pictures at intervals to record movement

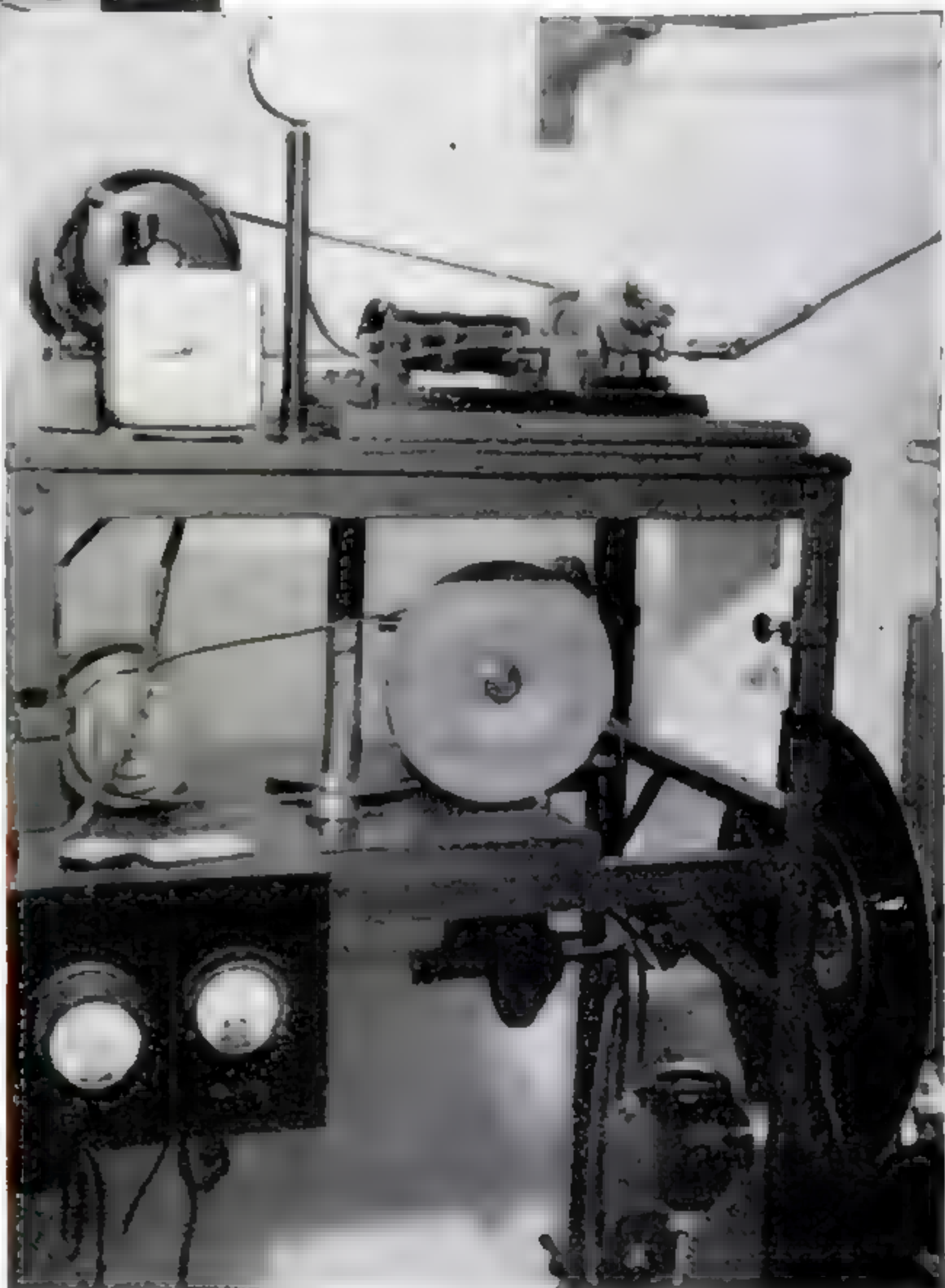
With Ingenious Apparatus,
Scientists Film Activity
of Deadly Germs To Show
How They Attack Tissues

By
ARTHUR C. MILLER

• •

WITH deadly microbes as actors, scientists in a New York University laboratory are making unique lapse-time microscope movies which promise to contribute valuable aid in studying the mystery of cancer and other dread diseases.

By applying the technique of the cameraman who snaps a series of pictures at regular intervals to produce a movie of an unfolding rose or lily, Dr. Robert Chambers and his associates are obtaining films that show the development of germs and tissues. Instead of a series of static photographs made through the microscope, their method records activity—impossible to see with the unaided eye—in continuous, smooth-flowing action. Medical men watching the completed mo-

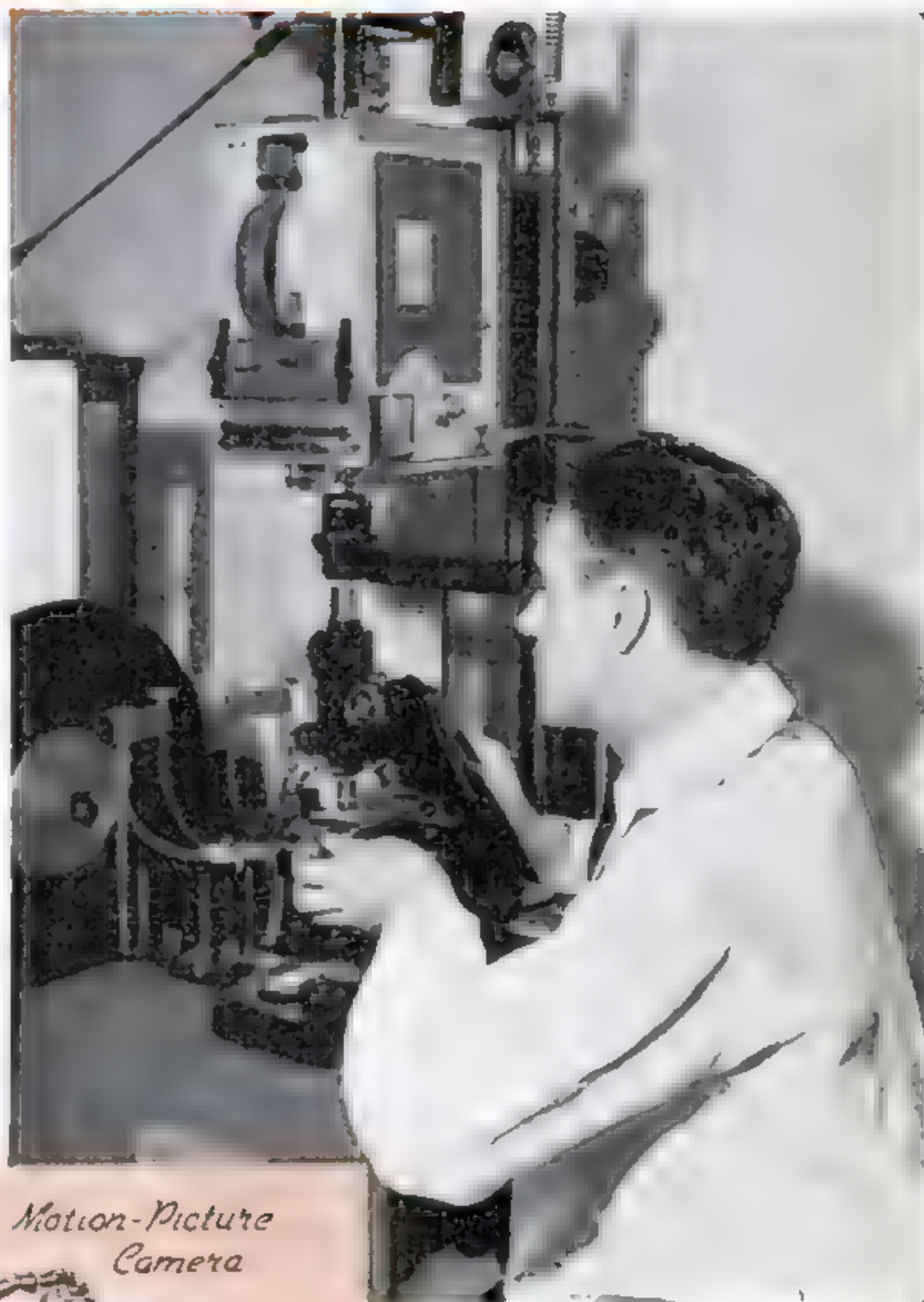


Fight Disease

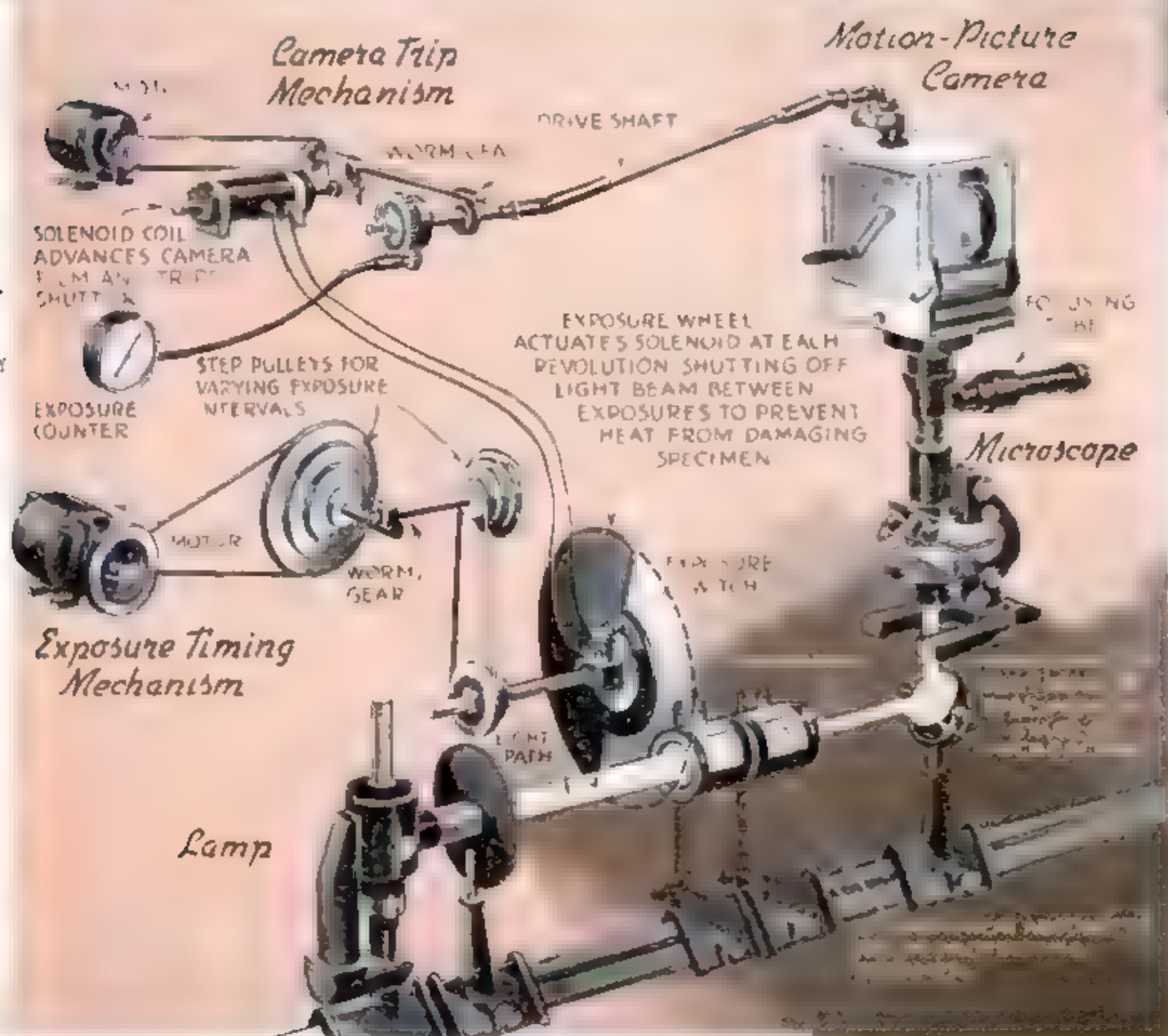
vies are thus enabled to see developments, which often require days and even weeks, taking place before their eyes in a few moments.

To achieve this result, an intricate automatic apparatus had to be devised in the laboratory. A thirty-five-millimeter movie camera is fitted to the eyepiece of a powerful microscope. Beneath the lens of the microscope, slides holding microbes or bits of living tissue are placed in a concentrated beam of light projected upward by a tilting mirror. To prevent heat from the beam killing the microbes on the slide, the light is passed through two cooling cells.

A diaphragm, similar to that on an ordinary camera, controls the size of the beam and a rotating disk, suggesting a pie with a section cut out, determines the exposures of the individual frames of the movie. The mechanism can be adjusted to give exposures over a wide variety of time lapses. One hundred frames a second can be snapped automatically with the apparatus run-



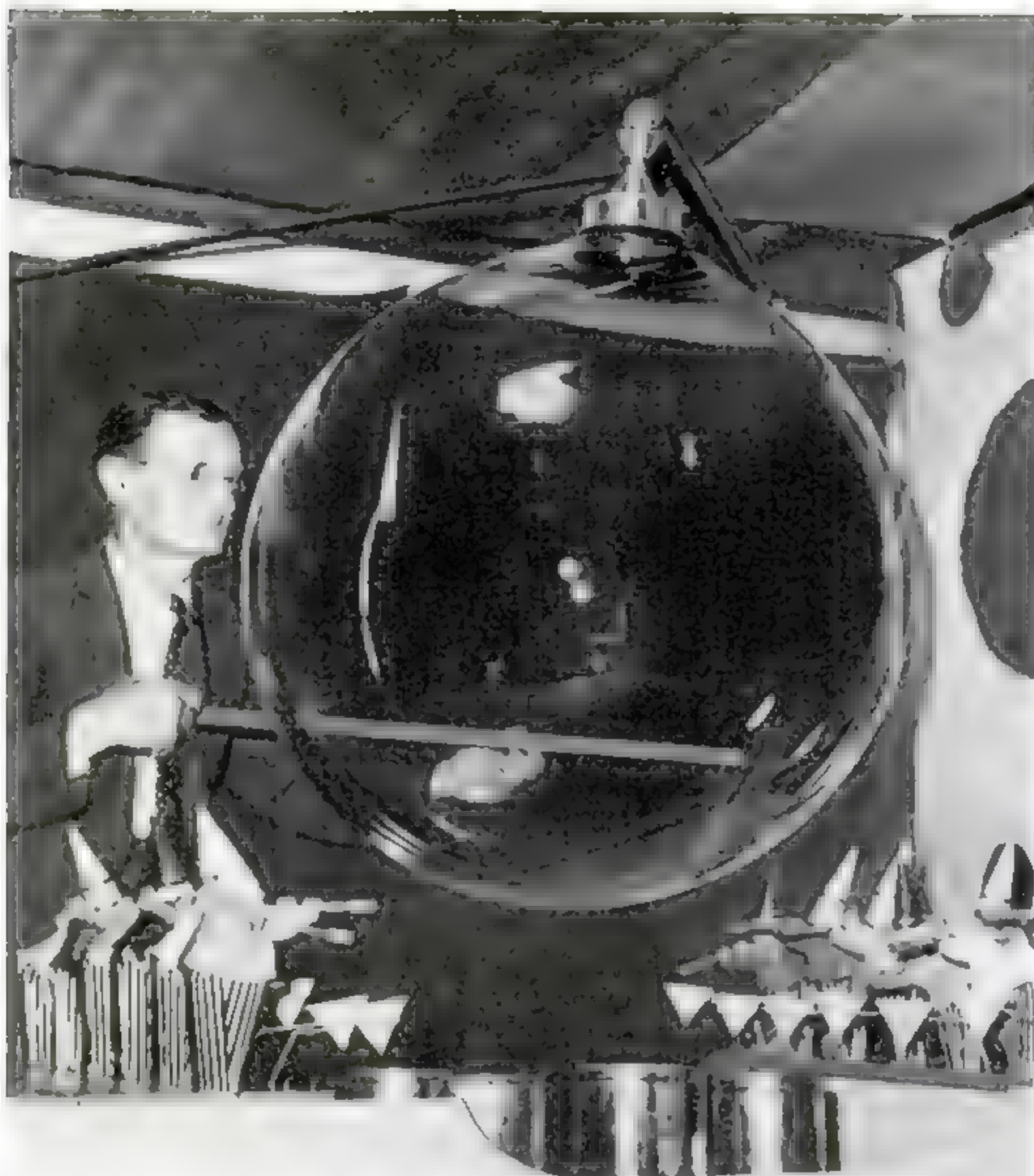
Dr. Robert Chambers focusing the microscope, above which the motion-picture camera is seen



How the camera, microscope, and operating mechanism are assembled. The film record is made automatically, at any speed that may be desired

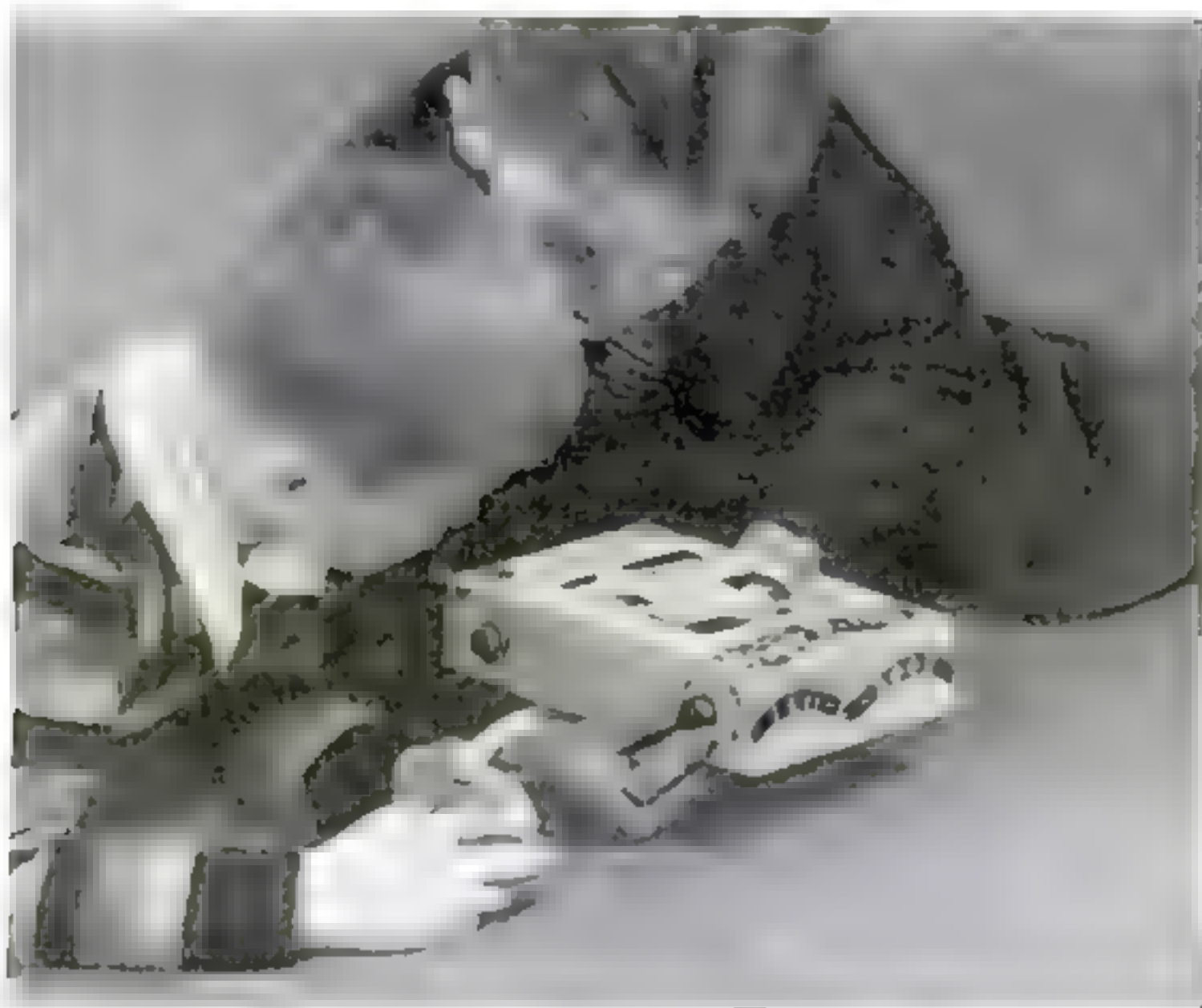
ning at top speed. At the other extreme, one frame every half hour is recorded on the film.

Each time the disk rotates once it closes contacts which set a second electric motor running to move the film in the camera one frame ahead. At the same time, an ingenious clock arrangement automatically indicates the exact time the picture was taken. Virtually without attention, the machine completes its scientific record of the invisible action taking place on the slide of the microscope.



Blowing Giant Bubbles Is His Hobby

BLOWING giant soap bubbles is the hobby of Robert F. Warham, of Piedmont, Calif. He has been at it for twenty years and under favorable atmospheric conditions has produced a bubble nine feet in circumference. He is shown above with a bubble-blowing machine he has perfected. Thought to be the only one of its kind, it has twelve mechanical puppets which dip into soapsuds and blow bubbles.



Turning knobs on the side moves the story past a window

Danger Line Shows When Tire Is Ready To Take New Tread

WHEN the tread of a tire of new design has worn down until the body of the tire is in danger if it is not retreaded, a red line appears as a warning signal. The red indicating line is located between the tough outer tread and the inner compound which is made particularly adaptable to retreading. A new tire and one worn to the danger point are shown in the illustration below.



Note the dotted line on the worn tire showing it needs retreading

Children's Roller-Book Has No Pages To Turn

PROVIDING children with a "movie in a box," a new type of roller-book has been placed on the market by a Syracuse, N. Y., publisher. The 2,000 square inches of words and pictures are printed on a roll so there are no pages to turn. The continuous roll is permanently mounted in a box on the sides of which are knobs for bringing the various sections of the strip before the window in the front of the container. Two inches thick, the roller-book measures eight and a half inches in height and five and three quarter inches in width. Pictured in use at the left, the roller-book is considerably lighter in weight than an ordinary one of the same size.

Sailbike

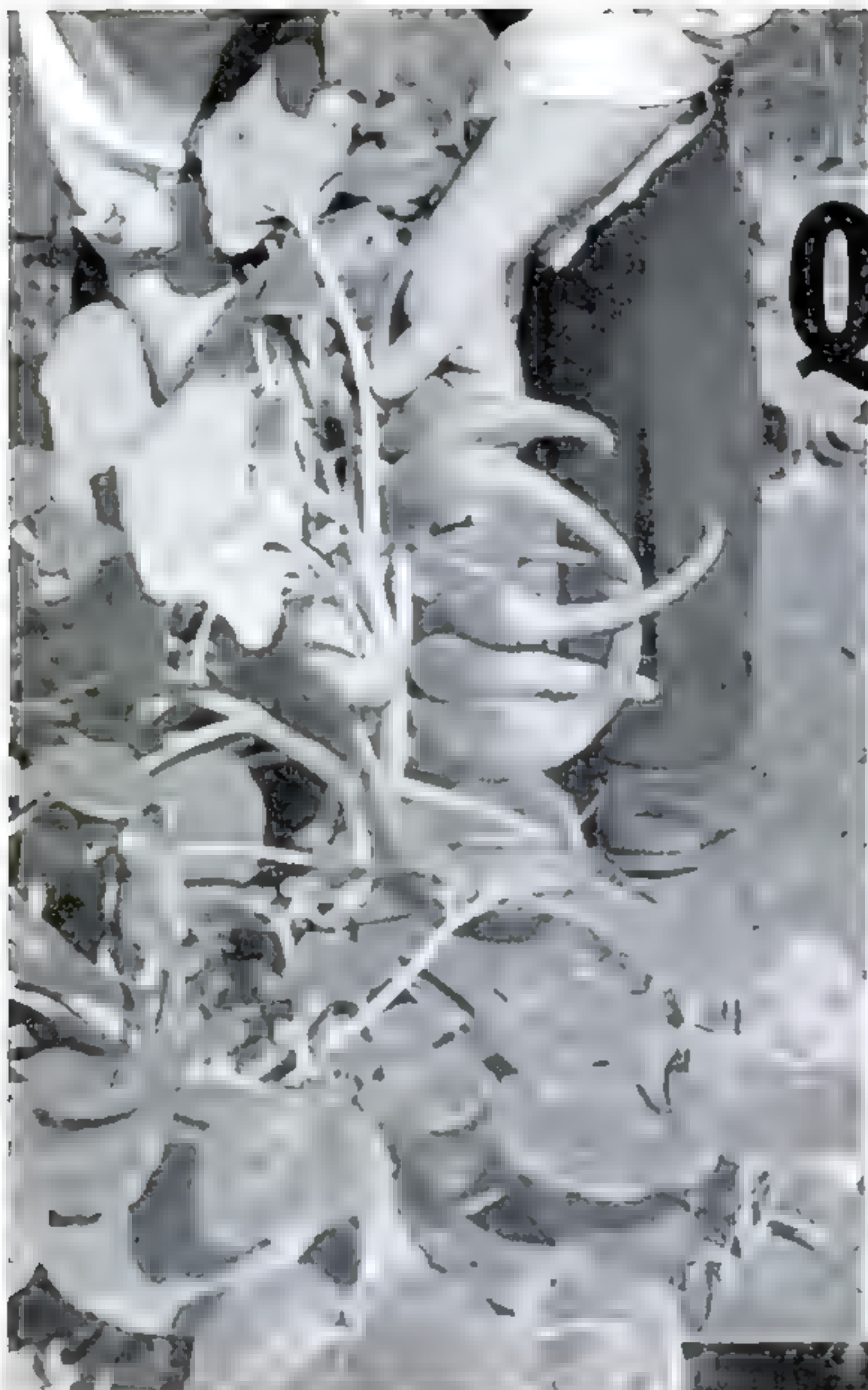
**PROPELLED BY WIND,
ODD BEACH VEHICLE
GIVES THRILL RIDE**

WHEELING over hard-packed sand at high speeds, an odd vehicle designed and constructed by a European inventor combines features of a bicycle, a scooter, and a sailboat. Starting with the framework of a tandem bicycle, the inventor joined the front and back wheels with a tubular steel framework that supports a wooden, scooterlike platform into which was stepped a wooden mast. The latter is braced by steel tubes, two of which terminate at the hub of the rear wheel. A mainsail strengthened by six battens was then attached to the mast, with its control lines running over pulleys and terminating at the handlebars of the sailbike.

Two persons can ride on this combination bicycle, scooter, and sailboat. Made from the framework of a tandem bicycle, it is capable of high speeds on hard-packed sand

Here the builder is rigging the bike for a sail. The operator maneuvers his odd vehicle by means of control lines that run over pulleys and terminate at the handlebars in easy reach





"Birds" growing on a bush. This is the Australian bird plant with its seed pods

Garden of Queer Plants

By WALTER E. BURTON



When ripened, the seed pod resembles a bird

ODDITY plants from all over the world grow in the curious gardens of Hyman Weinstein, at Massillon, Ohio. During the past dozen years, Weinstein, a traveling man, has collected botanical curiosities as a hobby. His strange assemblage now includes upwards of 100 unusual members of the vegetable kingdom.

Sensitive plants which fold up and apparently wilt and die if touched; strawberries without runners; a plant from Hungary which produces a lawn that never requires mowing; an Australian vine with seed pods shaped like birds; all are to be found growing in the Massillon gardens.

Carnivorous plants which catch and consume insects have, of



Hyman Weinstein exhibits a curious insect-eating cobra plant



Leaves of the life plant, at left, will sprout new plants if they are removed from the stem. At right is the runnerless strawberry

course, a prominent place in Weinstein's collection. These include the Venus flytrap and various pitcher plants, one shaped like the reared head of a cobra. Some of these meat eaters, when they cannot get a sufficient number of insects, have to be fed bits of raw beefsteak.

Another curiosity is known as an artillery plant. It gets its name from its habit of behaving like a miniature field battery in the spring. When the pollen is ripe, the flowers suddenly seem to explode, throwing out the pollen in a cloud of dust like powder smoke.

Weinstein gets his odd plants in a variety of ways. He orders some through nurserymen, he trades some of his curious specimens for others, he obtains seeds by writing to members of the U. S. diplomatic service in far-away countries. At the present time, he is on the trail of a botanical freak known as a gas plant. It gives off an inflammable oil, which has an odor resembling lemon, in such quantities that when a match is held near it, the whole plant seems to burst into flame.

Converted Car Motor Powers an Airplane

AFTER years of experimenting, Charles Ferraro, a Minneapolis, Minn., aircraft designer, has succeeded in converting a Model A Ford automobile engine into an air-cooled power plant for use in an airplane. Installed in Ferraro's homemade cabin monoplane, the converted engine weighs only 190 pounds and spins the propeller at 1,725 r.p.m. on the ground. To convert the water-cooled power plant, Ferraro cut long holes in the water jacket and attached finned aluminum castings to the front, rear, and sides of the motor. Oil from the pan is passed through the block to transfer the heat from the cylinder walls to the finned castings. These castings are inclosed and air is forced through the fins for cooling. A kit of instructions and parts has been prepared which, it is said, enables anyone handy with tools to make the conversion.



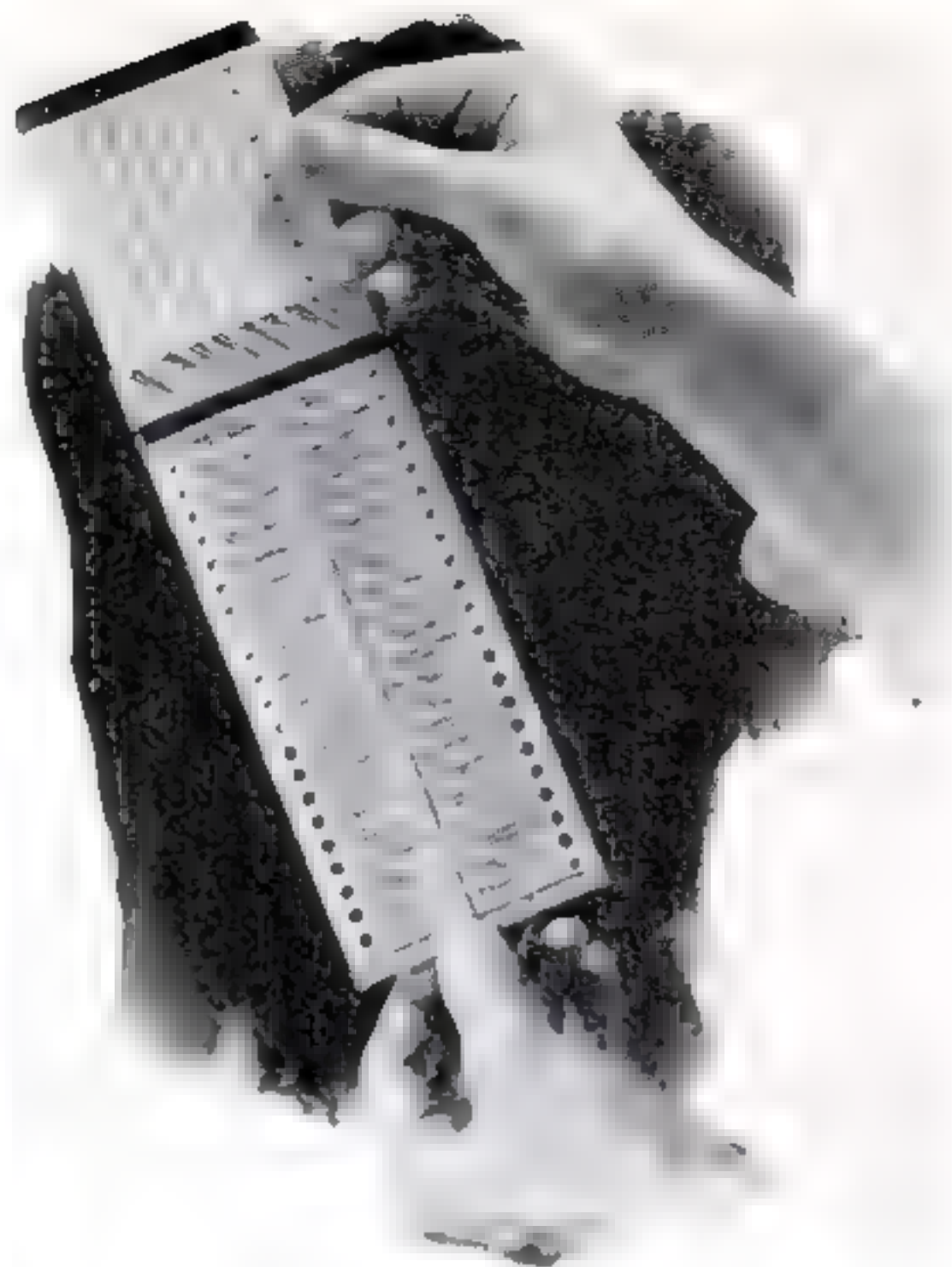
Model A Ford motor adapted for use in a plane. To make it air-cooled, holes were cut in the water jacket and aluminum fins added. Upper picture shows a plane in which it is used

Miners Get Baths for Health

MINERS in an English colliery are now provided with a therapeutic bath for the treatment of ailments prevalent among underground workers. In the photograph below, a miner is shown operating a tap which controls the flow of compressed air into the water of his bath.



A miner using the therapeutic bath to combat occupational disease



Slide Rule Guides Presiding Officer

ANSWERS to more than 300 questions in parliamentary procedure are provided by an indicator recently developed to aid club officers in conducting meetings. A rectangular slide moves up and down in an envelope marked with proposals most often made by members. The inner slide is adjusted for the proposal under consideration, and the proper procedure is read on the line of the slide just above the top of the envelope.

Test Liquid Coal as Fuel for Cars

"LIQUID COAL," a new motor fuel developed under the direction of Dr. Francis W. Godwin, of the Armour Institute of Technology, in Chicago, Ill., (P.S.M., Sept. '39, p. 226) is being tested as an economical substitute for gasoline. Forty percent coal and sixty percent cheap range oil, the mixture is only half as expensive as regular gasoline. No change in the motor is required except removal of a fine screen from the carburetor.



Dr. F. W. Godwin pouring liquid coal into the improvised fuel tank

Optical Illusion Improves Visibility of Highway Markers

OPTICAL illusions are now being turned to the cause of highway safety with the recent development by Frank McLaughlin, a Chicago, Ill., industrial designer, of road signs that are said to have a three-dimensional effect, although they are actually stenciled flat on the pavement. Designed according to a mathematical formula that applies to each letter of the alphabet, the sign's property of seeming to stand up away from the street makes it visible to motorists 150 feet farther away than conventional road markers.

Blind Get Fair Map Printed in Braille

FOR the benefit of the numerous blind persons visiting the New York World's Fair, the New York Association for the Blind has made available a map of the exposition printed in raised Braille characters. Complete in every detail, the map is designed for use with a special Braille guidebook describing the major points of interest. In the photograph below, a blind visitor is shown "reading" the special map.



One of the Braille maps which now assist blind visitors at New York World's Fair



Their shape makes the stenciled letters appear to be standing up

Pressure Oiler for Gun Barrels

GUN barrels are said to be made rustproof by a special pressure applicator similar to an automobile-greasing gun. Designed to clean and preserve any style of small arms, and fitted with a tip for handling all bores up to .45 caliber, the nozzle of the device is inserted into the barrel of a gun, where it forces an anti-rust liquid into every crevice throughout the length of the gun bore. One filling services several rifles.



Forcing antirust liquid into a gun barrel with the applicator

Camera Artist Makes



Robert C. Heinze at work in his studio. His skill in restoring old photographs has won him a rating as one of the top-notch artists in an odd profession

FOR more than forty years, old tintypes and daguerreotypes, broken glass negatives, faded and mutilated photographs on which the subjects were hardly recognizable, have poured into the studio of Robert C. Heinze, New York artist and photographer. In a few days or weeks they have gone out again, each accompanied by a remarkable blemish-free copy, often as good as or better than the original when it was new.



HERE'S A SAMPLE OF HIS WIZARDRY

The original above is a battered ambrotype, a photograph on glass. An enlarged copy, printed for better contrast, is made and the scratches are all filled in with the white water color



Old Photographs New

Most of Heinze's business comes from friends and relatives of persons who have died, leaving behind no pictorial remembrance of themselves save some faded old photograph, or a group snapshot in which the subject is almost too tiny to be made out. Often Heinze is requested not only to restore a portrait, or to make an enlarged portrait of an individual who first must be isolated and lifted from a group, but actually to change the features or clothing of a subject. An arm, a leg, or even half a face may have to be restored. Changing a person's clothes is accomplished by appropriating the desired type of clothing from another photograph, applying it over the clothing of the original, and then re-photographing the result.

Amazing as are many of Heinze's restorations, his methods and materials are simple. A few water colors and brushes, an air brush, and an ordinary copying camera, are his chief tools. The "secret" of his results is merely a matter of artistic ability combined with painstaking care.

Heinze never works on the original print, but starts by making a photographic copy of it. In the example illustrated, the original is a small glass ambrotype, and the copy must be enlarged and printed with greater contrast than the original. Work on the copy begins by filling in all the black scratches with white water color, applied with a fine sable brush. As it is desired to have the background finally of a uniform medium tone, this is completely painted over with white. Next the eye and other dark details are carefully drawn in with grays.

To make subsequent retouching easier, this partly retouched copy is recopied. The broader areas of the face and clothing are smoothed out by careful use of the air brush, and the background is also worked in with this tool. The second copy is once more copied for finishing and toning the final print.

By
**KENNETH M.
SWEZEY**



Here Heinze is restoring the missing right eye. Imperfections remaining on the first copy are removed on a second. Below is the final print



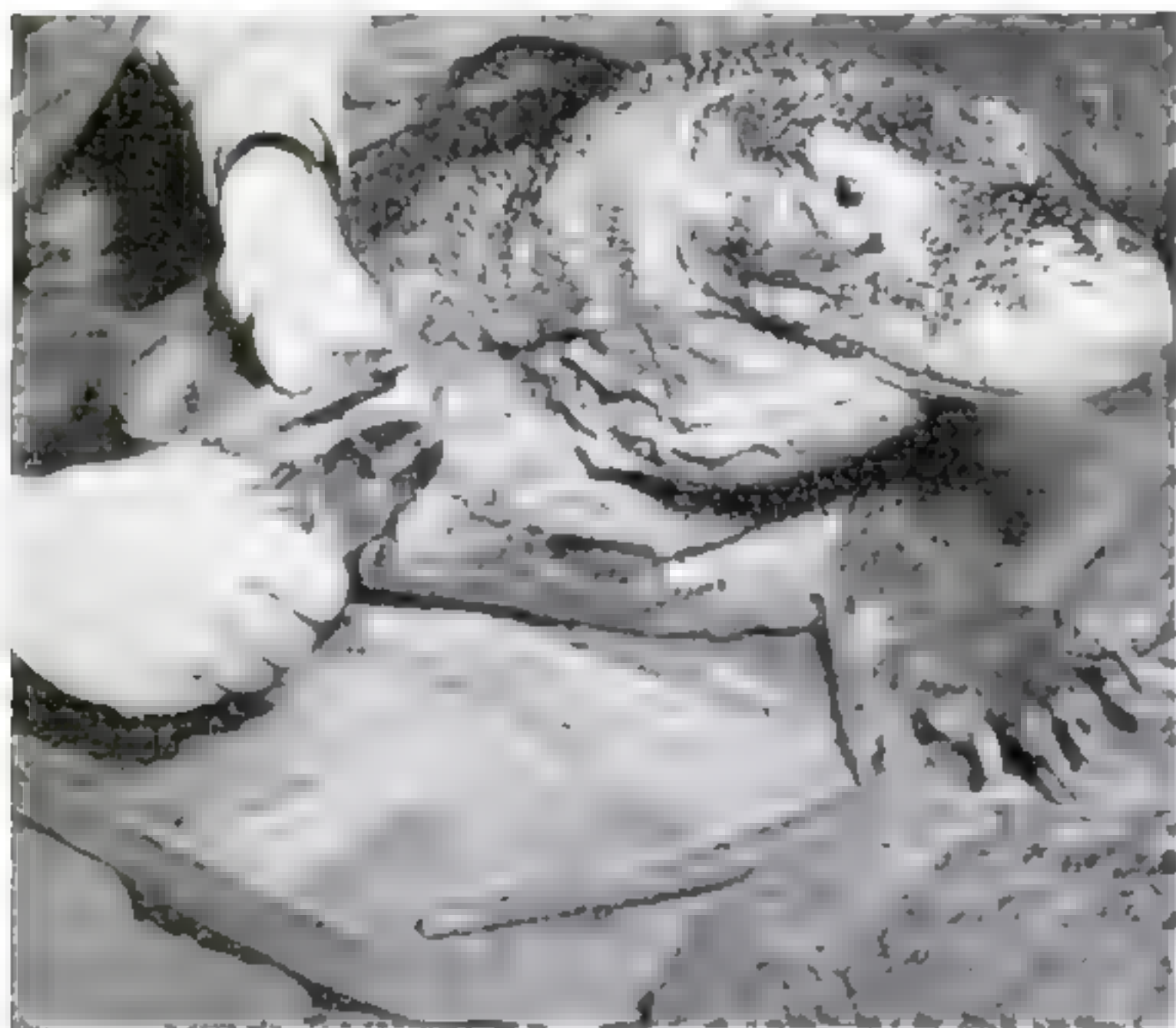
Not a new kind of bathing float, but a lightweight metal traveling case being tested for its water-tight qualities. Below, it is serving as a card table in the pool. After the test, the interior was dry



Waterproof Metal Luggage Given Swimming-Pool Test

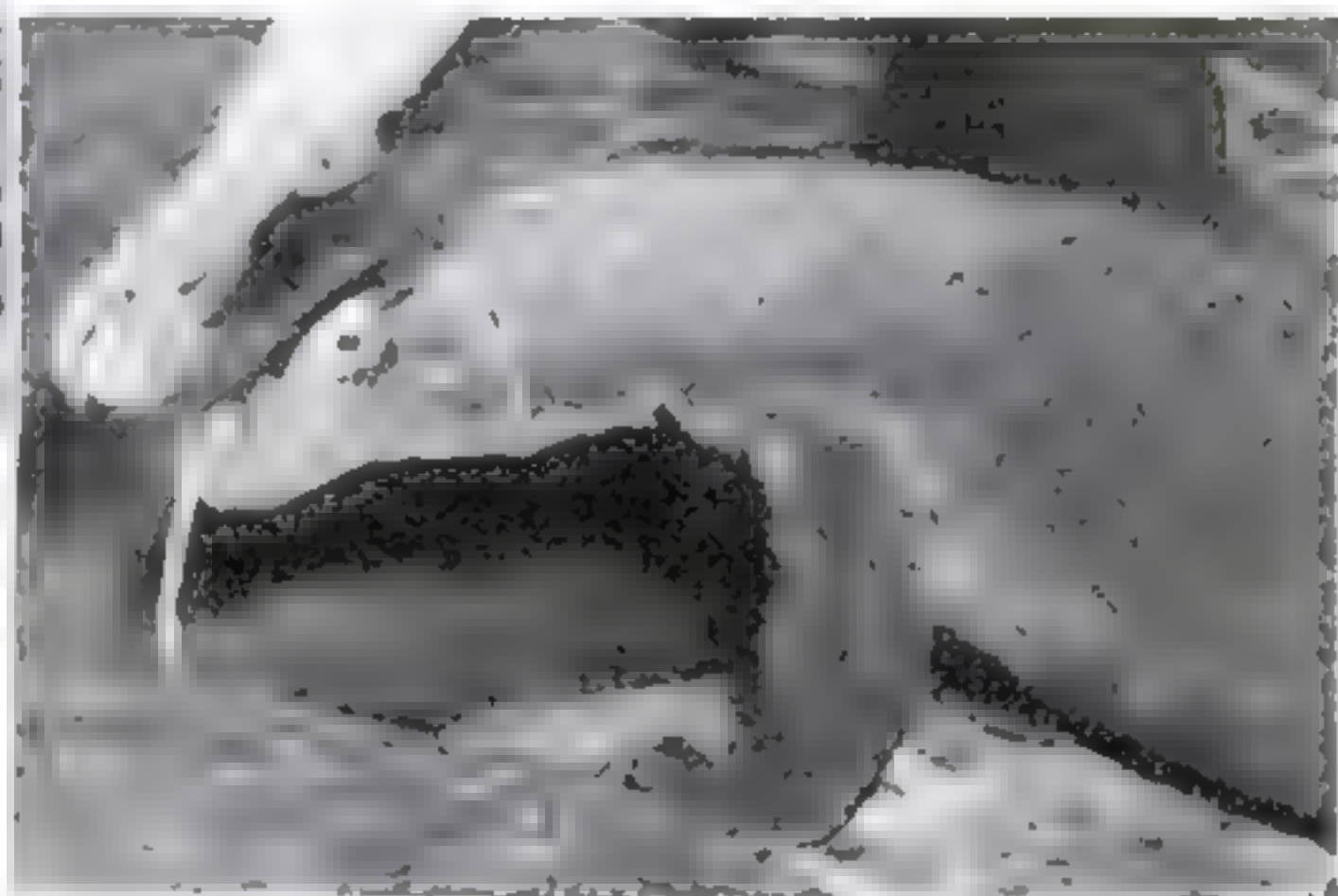
TO PROVE that a new type of lightweight metal luggage is absolutely waterproof, a manufacturer recently arranged the swimming-pool demonstration pictured above and at the left, in which a suitcase floated easily on the surface, and even supported the full weight of a swimmer, without leaking.

Zoo Dragons Get Their Claws Manicured



One of the two Komodo dragons at the Philadelphia zoo having its claws trimmed. It's a ticklish job, as the claws have nerves and blood vessels in them. At right, the rare lizard gets an egg as its reward for being a good dragon

MANICURING the menacing claws of a pair of Komodo dragons is the unenviable job assigned to keepers in the reptile house at the Philadelphia, Pa., zoo, where the only living specimens of these curious lizards in captivity are housed. Unlike human finger or toenails, the dragons' claws have nerves and blood vessels running through them, which the keeper must avoid to prevent injury to the valuable reptiles. An egg is the reward for good behavior during the process.





"Sun-Power" Machine Drives Electric Fan

TO DEMONSTRATE the possibility that man may some day generate all his electric power from the sun, Westinghouse research engineers recently built for display purposes a novel thermo-electric generator which produces from the heat of a tiny gas flame sufficient power to run a small electric fan. When a convenient switch is thrown, the electricity also can be made to illuminate a small sign built into the device. Resembling a large, transparent coffee urn, the apparatus utilizes 190 separate thermocouples connected in series. Each thermocouple, a device that turns heat directly into electric current, consists of two metal alloys welded together. The welded junctions are heated by the gas flame, causing current to flow. From all 190 thermocouples, eleven watts are produced, sufficient to operate the fan or the sign. The amount of gas required is twenty cubic feet an hour. Sunlight, concentrated by means of lenses and mirrors, it is explained, could be substituted for the gas flame, although science has not found a way to make this commercially practical.

Toy Shoe Trains Tiny Tots

A SHOE destined to be laced up many times and yet never worn, has been placed on the market by a Pennsylvania manufacturer. Designed to enable young children to practice and master the technique of lacing up a shoe, this oversize model also has great play value, since it is filled with bright-color beads that can be strung on the extra laces provided with the outfit.



Melting Ice Lowers House

COOL thinking paid dividends recently to Bruce Adkins, an Alamo, Tex., house mover. Adkins had moved a house from one location to another, and wondered if he could ease the arduous task of settling the dwelling on its new foundation by the difficult and laborious procedure of lowering it on a number of large jacks. Finally, he shoved a dozen or more large blocks of ice between the foundation and the house, removed the jacks, sat down in the shade, and coolly watched the dwelling settle evenly and gently as the ice melted.

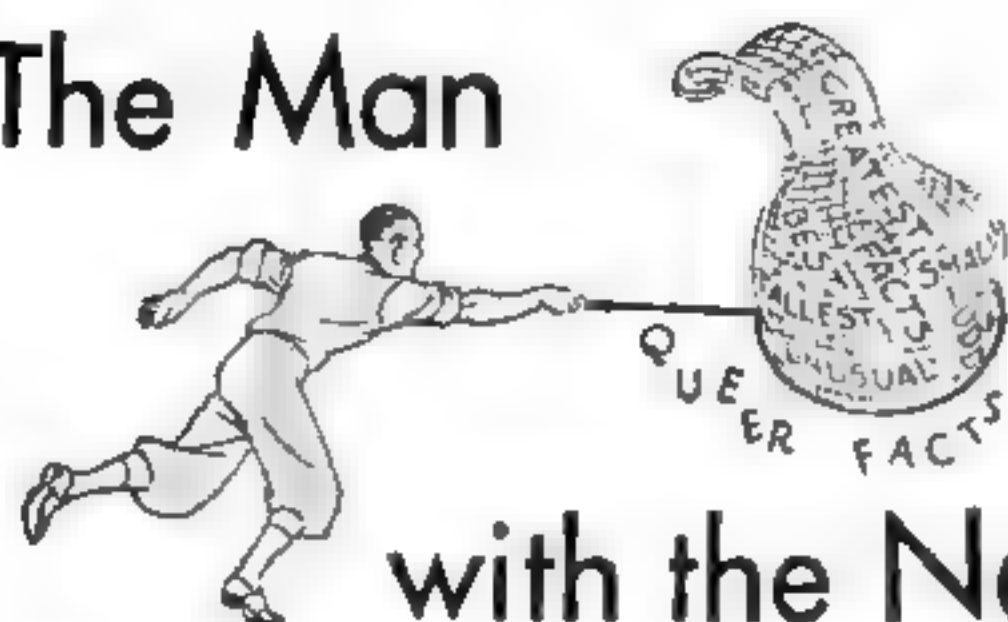


Bike Keeps Family in Stitches

CARRYING four persons and a sewing machine, the world's weirdest bicycle recently had a tryout in Chicago, Ill. The two-story vehicle, known as the "Goofybike," is the creation of Charles Steinlauf. It carries the whole Steinlauf family. The inventor rides at the top and guides the contraption

by means of a huge automobile steering wheel. Mrs. Steinlauf sits below, operating a sewing machine, while her son pedals behind and her daughter rides on the handlebars in front. When the odd vehicle is at rest, the projecting legs of the sewing machine prevent the lofty cycle from tipping over.

The Man



with the Net

BETWEEN fourteen and nineteen years of age, a boy requires more food than a man.

WATER, following the bed of the Mississippi River, flows north, east, south, and west.

SMILING requires the use of fewer muscles than frowning.

FISH taste with their whole bodies.



TEACUPS made of tea, compressed so solidly that hot water melted only a small part of the inside, used to be employed in Siberia. One such cup would provide tea for six months.

INSTRUMENTS that measure the density of sap have been devised to aid in the making of maple sirup.

PIGEONS cannot hear human voices.

AIN'T THAT
A BREAK?



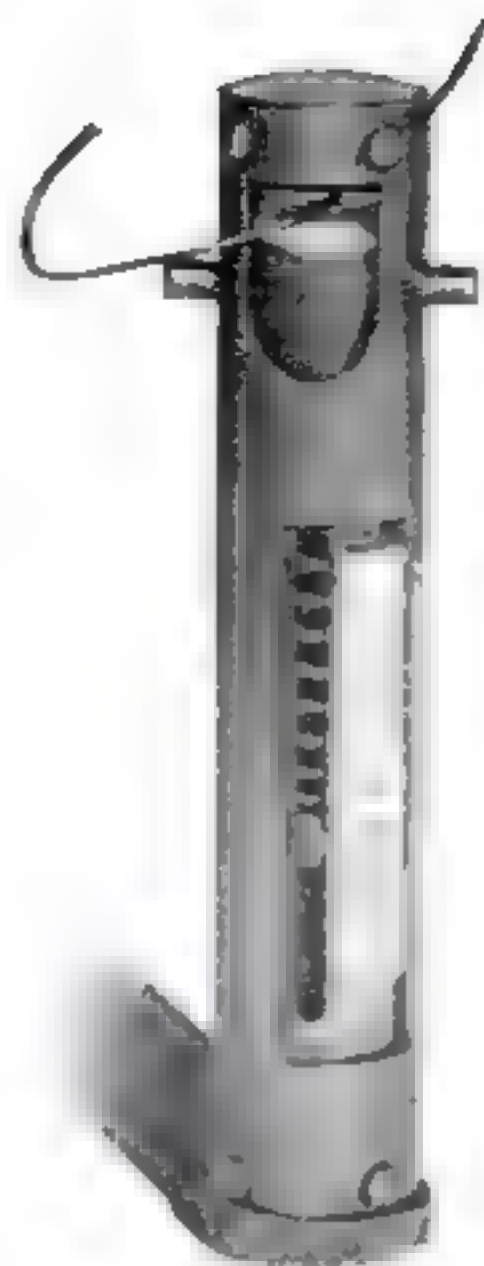
CARLSBAD CAVERNS in New Mexico have yielded more than 100,000 tons of bat guano.

PERSONS having brown eyes can see better at dusk than those having blue eyes.

ICELAND has 107 volcanoes.

MILE-A-MINUTE railroad speeds were attained in England as early as 1848.

COWS' tongues have five times as many taste buds as human tongues.



Handy New Tool Tests Enamel on Magnet Wire

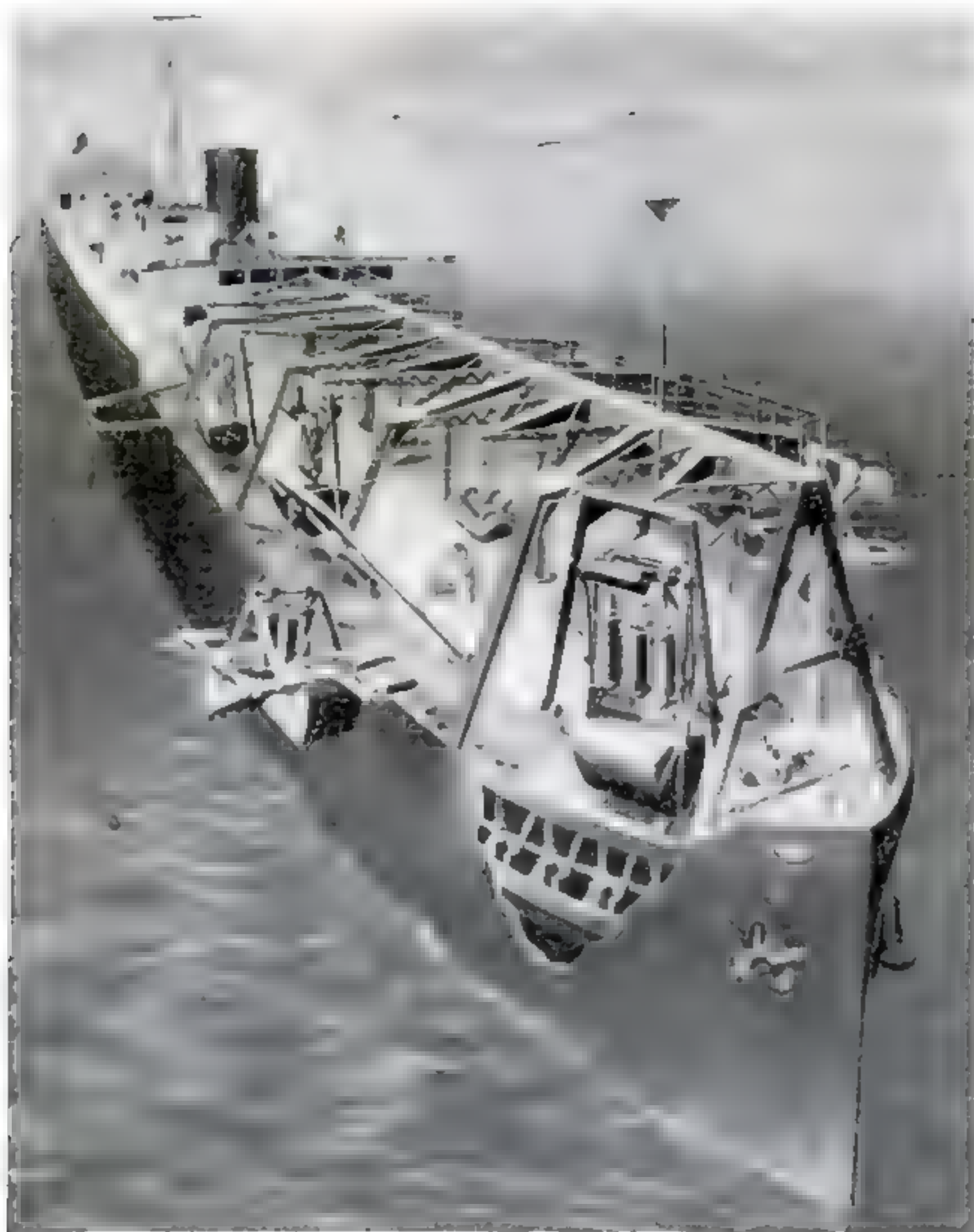
UNTIL the device at the left was introduced, practically every electrician was forced to test the quality of enameled magnet wire with his thumbnail. Now the wire is threaded into the pocket apparatus, a screw is tightened, and a calibrated spring presses a dull blade against the wire for the test.

One-Man Clay-Pigeon Trap

A NEW trap for hurling clay target pigeons into the air is portable and can be operated by the trapshooter himself. Weighing only twenty pounds and easily folded for transportation in a car, the adjustable machine fires either single or double targets at any desired angle. It is sprung either by hand, by an electric trip, or by a foot pedal as pictured in the photograph below.



The shooter operates this automatic trap himself. It hurls one or two clay targets at any desired angle



Plan of vessel to contain a complete deep-sea dredging outfit

Gold-Dredging Ship Taps Ocean Eldorado

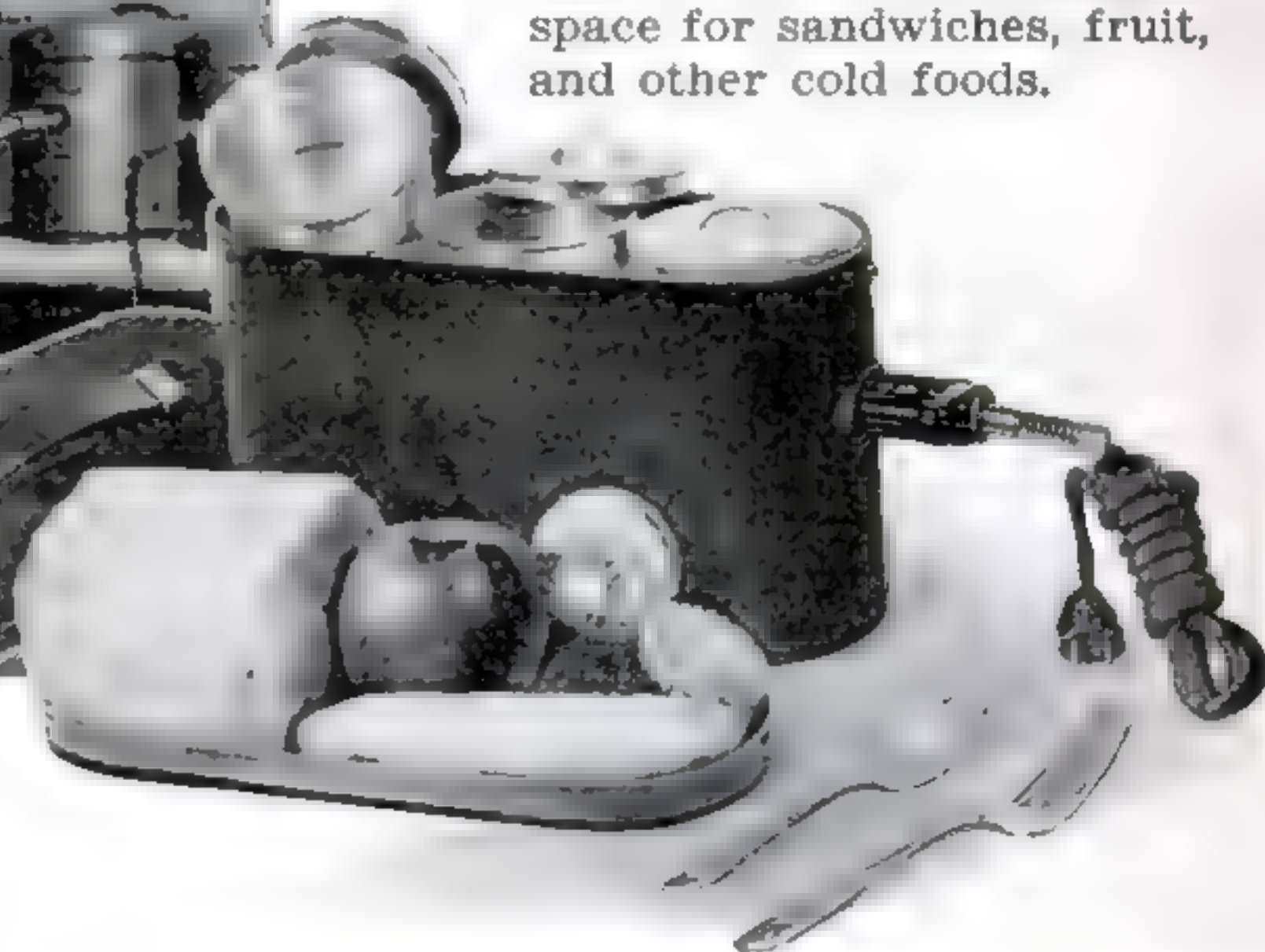
UNDERWATER deposits of gold and other precious metals, beyond the reach of present marine mining equipment, may at last be tapped, according to John C. Williams, western inventor and engineer, who recently announced plans for the construction of a 9,000-ton vessel that will be a self-contained deep-dredging outfit. In recent tests in Monterey Bay in the Pacific Ocean, the dredging equipment to be carried on the new ship demonstrated its ability to work at depths of 1,000 feet, and the completed outfit aboard ship, it is stated, will operate successfully at depths as great as 3,000 feet, or more than half a mile below the surface of the water. Dredges in use at the present time, it is said, cannot operate successfully at more than a third of this depth. When the gold-dredging ship is completed and its equipment installed, mining operations are expected to be started in the Stephens Passage in southeastern Alaska.

Electric Lunch Box Provides Hot Meals

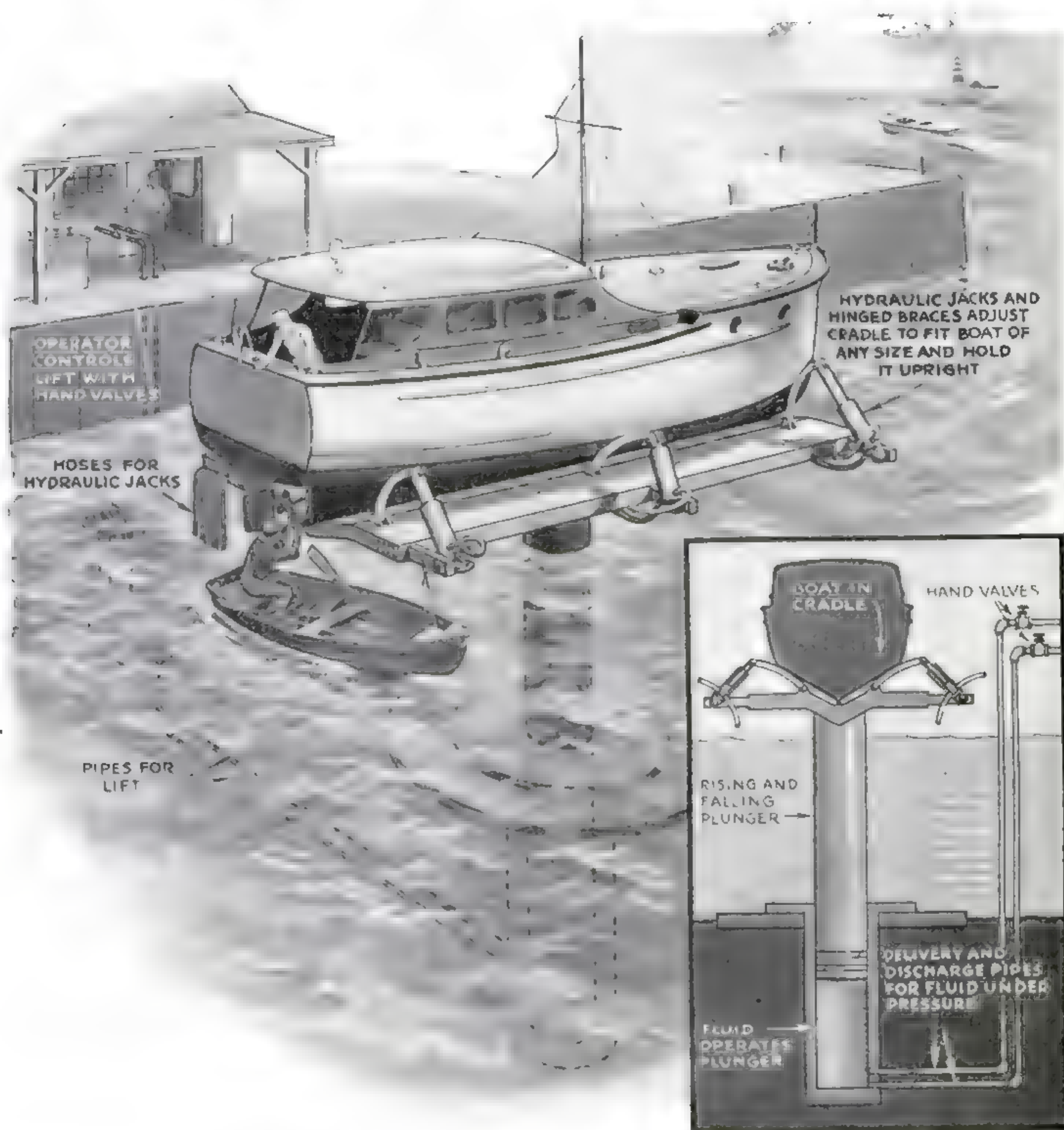


Lunch boxes on a factory shelf plugged in to warm food. Cold items are kept on tray at right, in an insulated lower compartment

PIPING-HOT meals are available at lunch time to workmen who carry a novel electric lunch box. Soups, vegetables, stews, creamed dishes, and other foods are carried in three metal containers that are electrically heated when the box is plugged into an outlet. An insulated lower section provides storage space for sandwiches, fruit, and other cold foods.



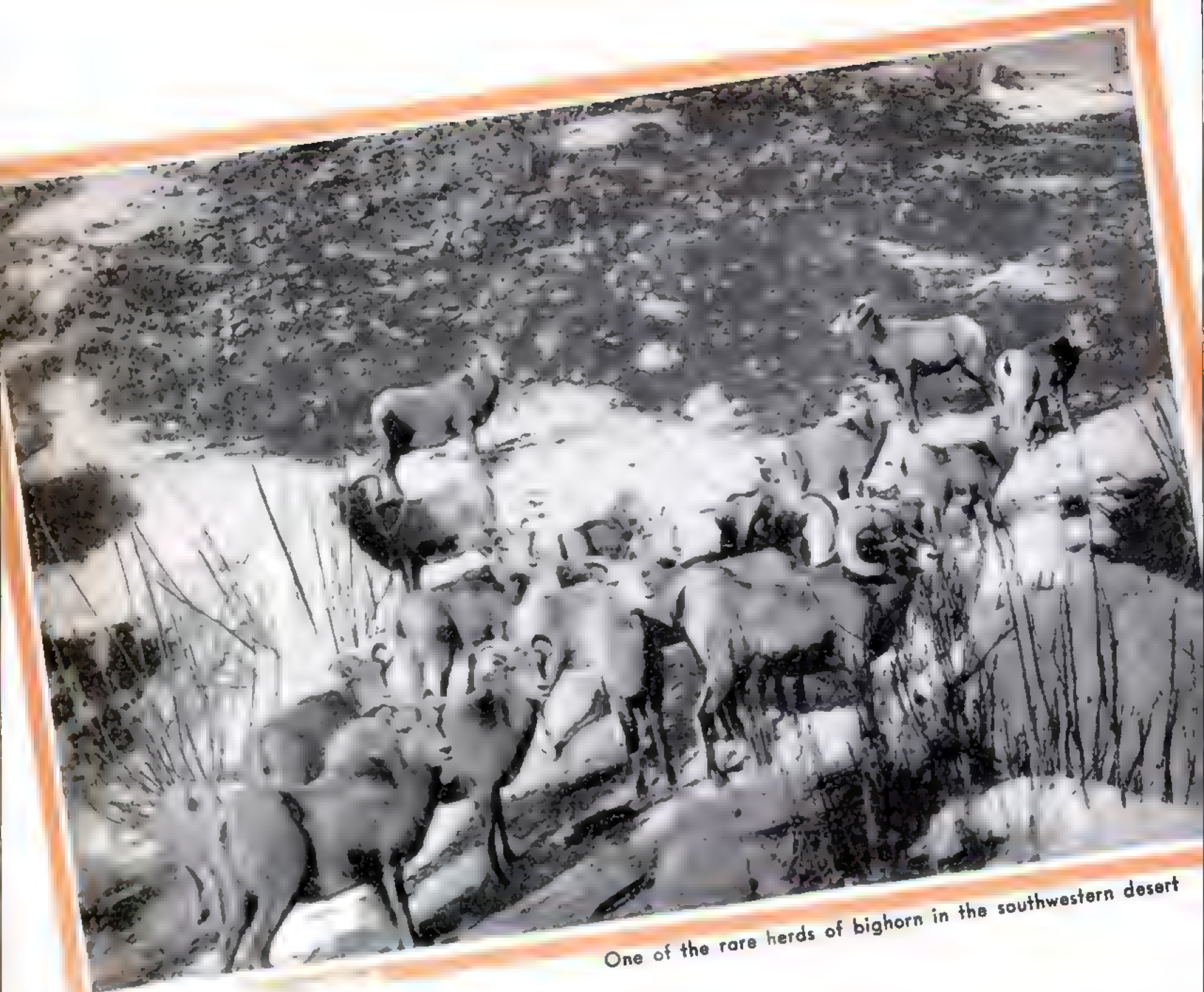
Rack Raises Boats for Repairs



How a small boat is lifted out of the water for repairs below the water line

LIFTED like an automobile on a garage oiling rack, a small boat cradled in the adjustable platform of a novel hydraulic ship hoist invented by Clifton L. Rogers, of Moss Point, Miss., can have minor below-water-line repairs made quickly without having to go into a regular dry dock or be hauled out onto dry land. Nosed into a slip, a small boat is maneuvered around until it lies directly over the hydraulic hoist mechanism embedded in concrete on the bottom. Valves are then opened, to force upward a metal plunger topped by a platform having a V-

shape groove in the center to accommodate the boat's keel. Hydraulically operated braces at the sides of the platform are adjusted to hold the boat hull firmly in place. The platform then continues its rise until the boat is high enough above the surface of the water to permit repairs to be made from a dinghy or rowboat. When the repair job is completed, the plunger moves down, lowering the boat gently into the water. The platform braces are then released and the craft, now floating free, moves out of the repair slip under its own power.



One of the rare herds of bighorn in the southwestern desert

Saving the Vanishing Mountain Sheep

○ NE day in the spring of 1937, a man headed west from Tucson, Ariz., in a specially built truck to begin what was probably one of the loneliest and most difficult jobs in the world. That job was to count the bighorn sheep in the deserts of western Arizona, and to learn all that could be learned about their habits of feeding, watering, breeding, and migration.

A simple assignment? Well, finding, stalking, and killing *one* good bighorn ram is considered by most big-game hunters as the ace performance of North American field sport. This man, who left Tucson so jauntily that morning, was undertaking to find, count, and

spy upon all the sheep in a desert wilderness 35,000 square miles in extent, the hottest, driest, most desolate region of the continental United States.

The man was Andrew A. Nichol, a range ecologist at the University of Arizona. He was sent out by the National Association of Audubon Societies, as the first step in a new movement to save the vanishing bighorn.

If the sheep were to be saved, any steps toward that end had to be founded on hard, cold facts. Why had they decreased so alarm-

ingly? Besides man, what animals preyed upon them? What did they eat? How often did they drink? How much did they move about? When did they have their young and how many did they have? What steps could be taken to preserve them?

Let's take a look at the southwestern sheep country. It is a vast desert wilderness—flat plains and valleys spotted with high, barren, rugged mountain ranges that rise 2,000 and 3,000 feet. The annual rainfall over most of it is only about three inches, and in the summer the thermometer sometimes climbs to 115 and 120 degrees in the shade.

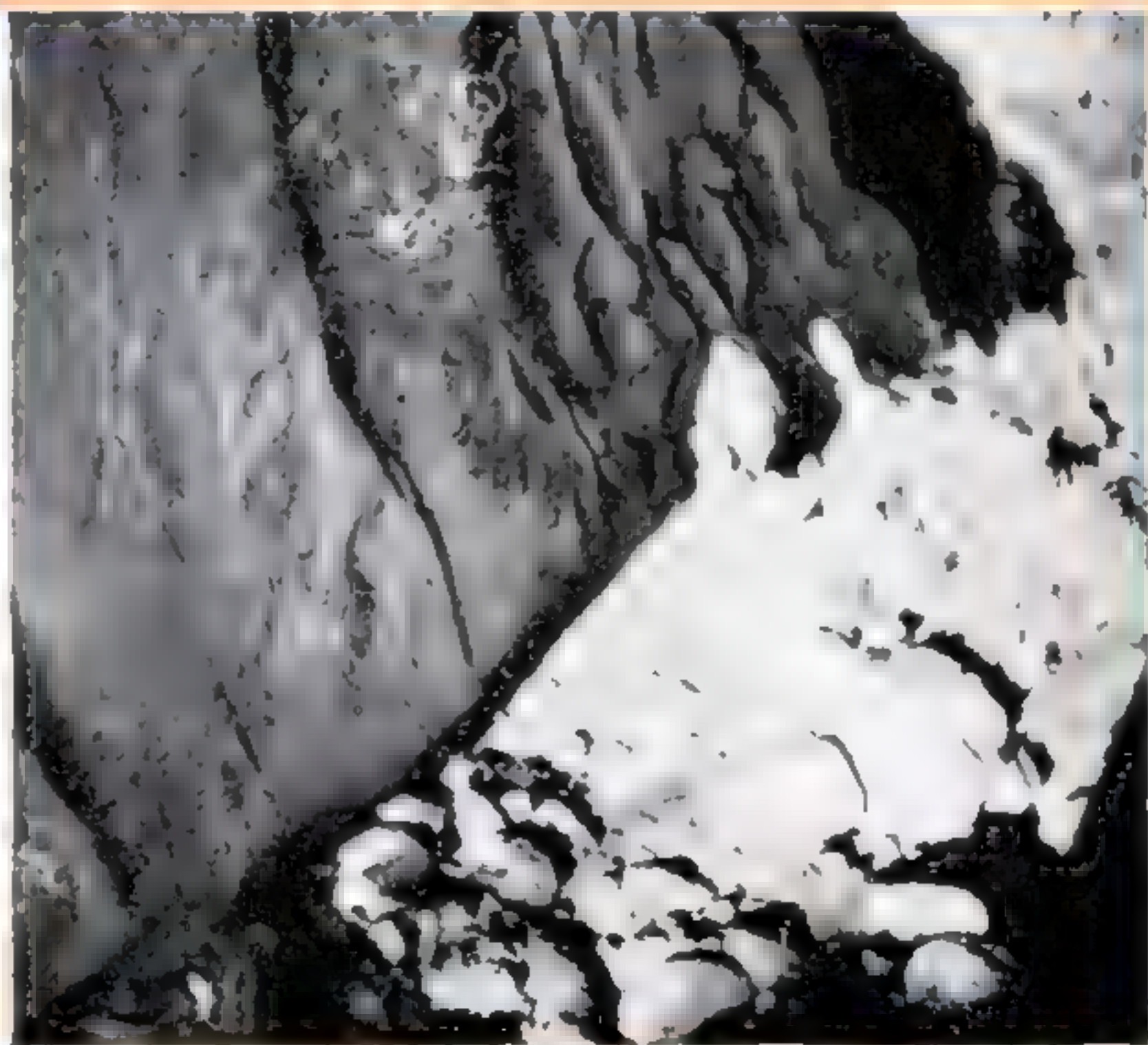
When Nichol began his difficult survey, he knew that the bighorns were decreasing, but he was amazed to discover the real extent of the decrease. Slowly he worked from range to range. Everywhere he found the same story: the animals had decreased

By JACK O'CONNOR

alarmingly, and today he estimates that there is about one big-

horn alive in the deserts to seven a decade ago.

Nichol has a map of the bighorn country with his estimates of the approximate number of sheep in each range. Here is a long mountain chain which in primitive days probably contained 1,000 sheep. How many now?



A mountain-sheep bed. By examining their noon resting places, Nichol estimates their numbers



This is typical bighorn country—the rugged but beautiful Kofa Mountains in Yuma County, Ariz.



From a lonely peak, Nichol scans the desert for sheep

Only nine! In many places where sheep once were numerous, where the great brown rams popped up on every ridge, and where tracks and droppings lay thick, the few survivors need but a push to send them into extinction.

The rough country of the arid Southwest once formed by far the best mountain-sheep range in the United States. The bighorns were found in California, Utah, Nevada, Arizona, and New Mexico. The Colorado River desert was the center of their distribution, and the animals ranged over practically the entire state of Arizona, wherever there was rough country relatively free from timber.

In the seventies the animals were present by tens of thousands, but the eighties and nineties saw them depleted in every range

where they came in contact with modern man. In spite of a long close season, they continued to go down, and now the known herds are confined to the western third of the state, the portion where the annual rainfall is so scanty that the land has hardly any value to man.

How can an accurate estimate of the number of bighorns in that great, wild country be made? The answer is, of course, that no absolutely accurate check *can* be made. The desert bighorn is the most mobile of all big-game animals. A range may have considerable sheep in it one month and none the next.

Nichol's counts are, however, often amazingly accurate. When he was on one of his surveys in the Kofa range in Yuma County, he saw not a single bighorn, but the sign told him that there should be fourteen sheep ranging in a certain basin and using a particular water hole. After he left, a couple of Government officials were in there. They happened to see the herd. Nichol was right, down to the last lamb.

How does he do it? How can one count animals he has not seen? It isn't so hard if you know their habits, Nichol says. A few sheep can leave much sign—tracks, droppings, nibbled twigs, all the things the hunter looks for. Many an unversed sportsman has seen droppings, tracked-up

ground, and has sworn the whole country was swarming with game when in reality all this was made by a half dozen animals. The thing to do is to find where the animals are ranging and then look for their midday beds. In the early morning the animals are somewhat restless, but in their noon beds they stay put.

Be able to tell how old the sign is, find and classify the different kind of beds, learn the characteristics of ram and ewe sign, and the rest is easy.

But finding where the sheep are ranging in the first place is no small assignment. The range may be five or ten miles wide and from twenty to thirty miles long. Somewhere in it there is a band of sheep. How does one find them?

By climbing! You take your canteen, a



Bighorn expert—Andrew A. Nichol. When he gets hot, he turns his undershirt into a hatband

scanty lunch, and your camera, and up you go. You go up a canyon strewn with boulders as big as houses. After climbing 1,500 feet you come out on a ridge, but now you can see that the comb of the range is still at least 1,000 feet above you.

You begin to see sign now, but all of it is old—beds, dried droppings, occasionally an almost obliterated track. But on the other side of the comb you find fresher sign. In a deep green pothole in a narrow canyon you find their water supply. If you're lucky, you may see the sheep themselves, as they lie on points where their telescopic eyes can sweep the country below them. You may see a movement in a basin below that your glasses will tell you is the moving head of a feeding ewe, and then you may pick up the others, one by one. Or a big ram may pop up just above you, stamp, wheel, and disappear.



Digging the specially designed truck out of the sands of the Tule Desert

Nichol traveled 35,000 miles on sheep work alone. How many miles did he walk? How many thousand feet did he climb? He won't even hazard a guess. Sometimes a man can drive a car right up to the foot of a bighorn mountain and camp there. At other times, one has to camp five miles or so away. It is really tough then. Try walking five or ten miles, then climbing 4,000 feet straight up, covering five miles or so more along the roughest peaks and cliffs in Amer- (Continued on page 224)

Hitch-Hikers Get a Waiting Room of Their Own

PERFORMING the role of the good Samaritan to the nation-wide fraternity of automobile hitch-hikers, the owner of a service station in Albion, Mich., recently established a hitch-hikers' depot hard by his row of gasoline pumps. Nailed to a tree, a large sign visible to approaching motorists at a good distance, identifies the spot, while a painted hand, with the thumb outstretched in the traditional manner, does the spade work for tired hikers.



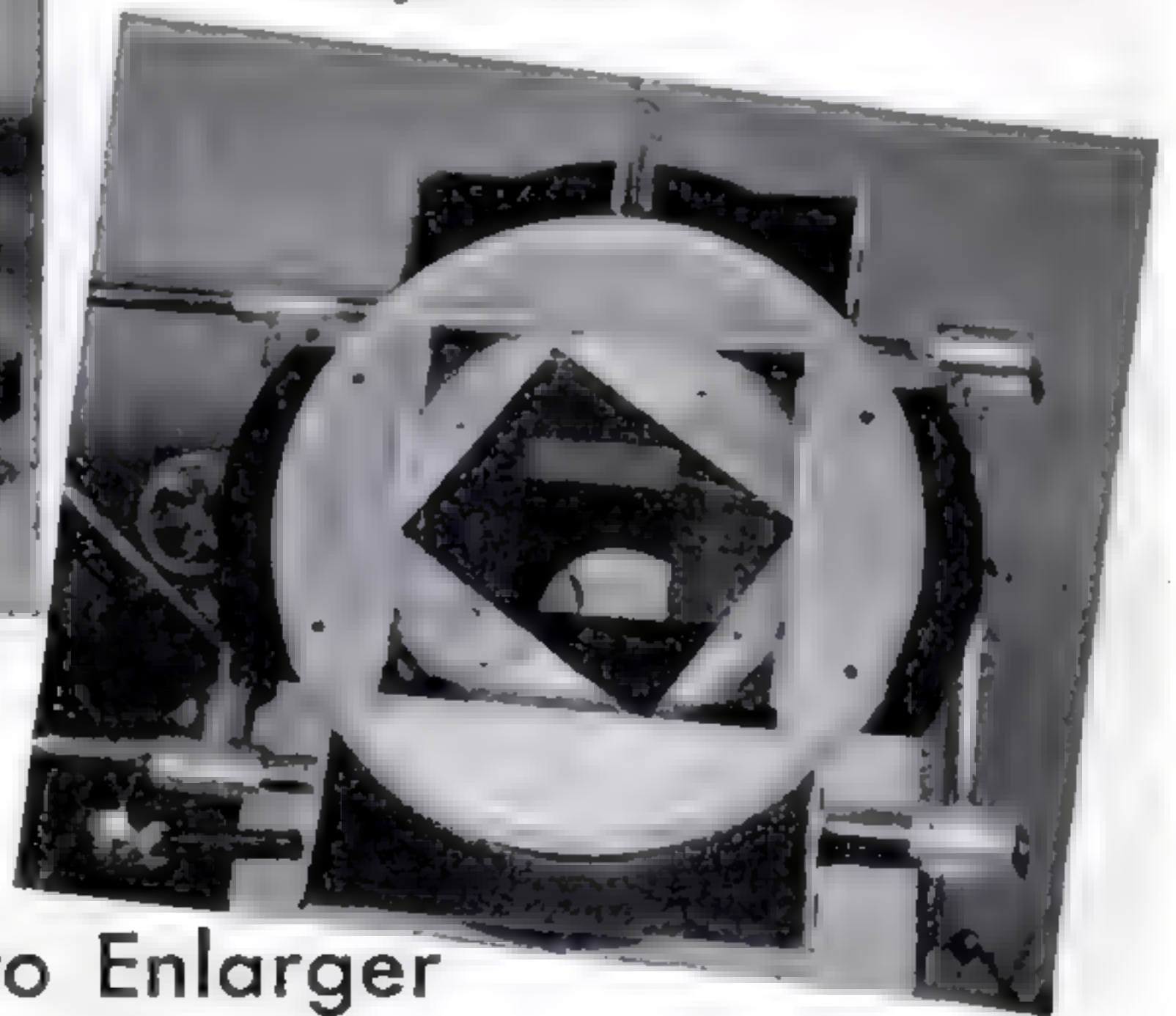
NEW EQUIPMENT



Extremely large projection prints are possible with the apparatus, even from miniature-size negatives. The negative holder, at right, adjusts from side to side and also revolves



Note the tilting lens board that corrects negative faults or allows unusual effects



New Precision-Type Photo Enlarger Gives Wide Variety of Effects

WITH a wide variety of unique features, a new enlarger developed at an eastern laboratory provides the photographer with unusual facilities for making large-size prints. Constructed entirely of metal, except for the bellows and interchangeable lenses, the enlarger is supported by five adjustable legs so

the unit can be leveled on any surface. The table holding the easel can be raised or lowered to vary the size of the image and to permit huge enlargements from tiny negatives. To correct distortion, or to produce it for unusual effects, the operator can tilt the lens board at any desired angle.

FOR CAMERA FANS

Double-Range Exposure Meter

ACCURATE readings in dim and brilliant light, beyond the range of previous photo-electric exposure meters, are said to be provided by a new meter just introduced by a New Jersey manufacturer. When measuring brilliant illumination, a door covers part of the light-sensitive cell; when measuring dim illumination, this door is swung back to expose all of the cell to the light. According to the position of the door, a "high light" or "low light" scale appears automatically at the front of the meter.



For bright-light readings, a perforated hinged door cuts down the light-cell opening

Automatic Darkroom Timer

AN ELECTRIC timer which automatically switches off the light in an enlarger or printer at the end of any predetermined exposure, from one to fifty-five seconds, is now available for use in a darkroom. Setting a pointer-knob for the number of seconds and pressing a button are the only operations required.



A button turns the lamp on for a predetermined time

Versatile Camera Tripod

BY REVERSING the tips on a new all-metal tripod recently placed on the market for camera enthusiasts, the user can have either pointed or nonskid rubber tips as he desires. Another feature is a universal tilt-top equipped to screw into either standard camera sockets or odd-size foreign ones.



Turning the rollers dries prints in less than five minutes

Rotary Electric Drier Gives Glossy Prints

DRYING prints and enlargements in from three to five minutes, a new rotary electric drier is said to improve the quality of glossy ferrotyped prints as well as to save time. The wet paper is laid on the drum of the device. Turning a handle then forces the prints in contact with the polished surface of the drum, in the manner of a clothes wringer. The electric heating unit quickly dries the photographs.

POPULAR SCIENCE *Question Bee*

Pretty good at science, are you? Then try to get sixteen of these twenty posers correct; in which event, go to the head of the class. To determine your exact score, turn to page 228



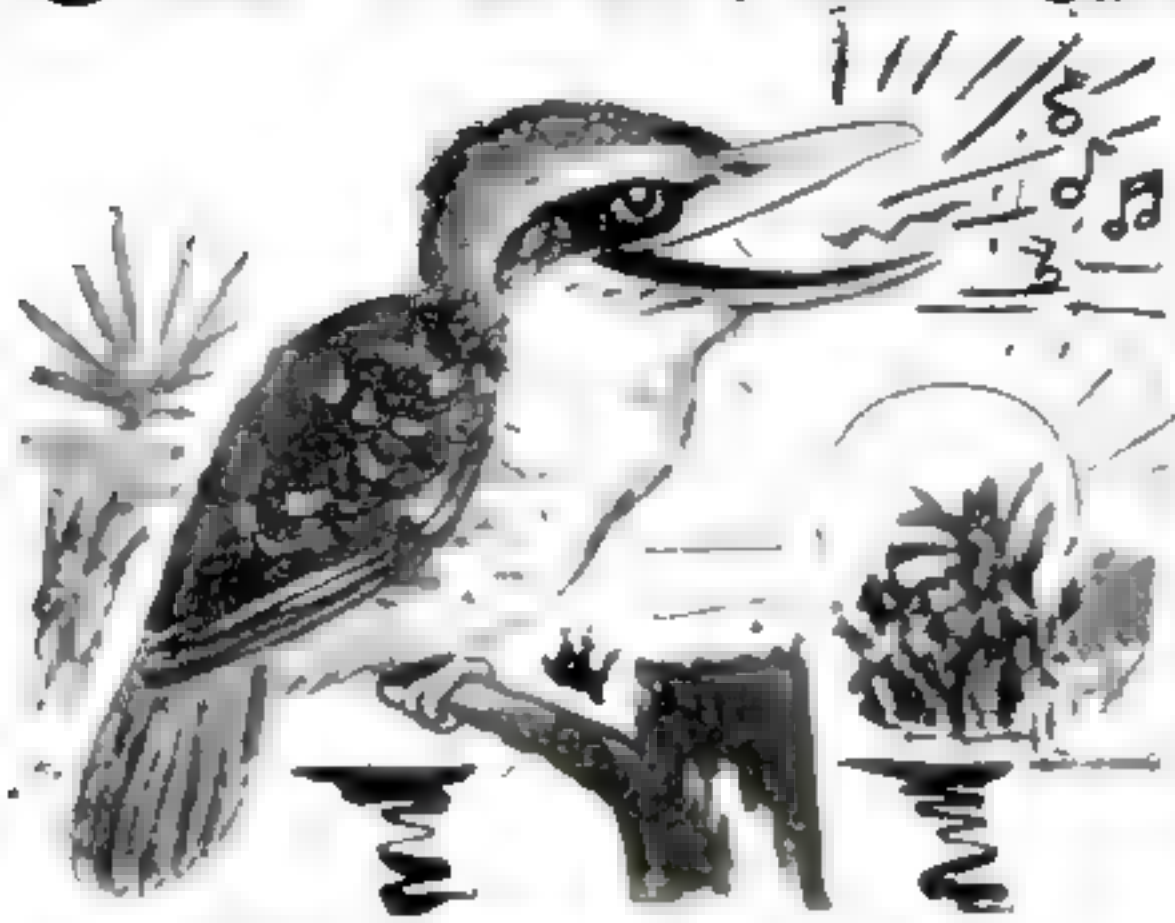
- 1 A clothes moth does its damage when it is (a) an adult (b) a larva (c) a pupa.
- 2 The high notes of an organ are produced by (a) long pipes (b) short pipes (c) lead pipes (d) bagpipes.
- 3 What determines the color of light is its (a) velocity (b) intensity (c) wave length.
- 4 You would expect to find trees in (a) a natatorium (b) an arboretum (c) a planetarium (d) a speculum.
- 5 When a ship passes from fresh water to salt water, it (a) floats higher (b) sinks lower (c) stays at the same level.
- 6 Ethylene glycol makes a good (a) ink eradicator (b) embalming fluid (c) auto antifreeze (d) insect spray.
- 7 U. S. battleships are named after (a) admirals (b) fish (c) states of the Union (d) mythological characters.
- 8 Compared with a fifty-watt lamp bulb of the same voltage, a 100-watt bulb has (a) more resistance (b) less resistance (c) the same resistance.
- 9 A siphon tube will not work in (a) air above normal atmospheric pressure (b) a total vacuum (c) a dry climate (d) the Southern Hemisphere.
- 10 United States coins bear the inscription (a) "Caveat emptor" (b) "Dieu et mon droit" (c) "Pro bono publico" (d) "E pluribus unum" (e) "Cherchez la femme."
- 11 The power of the lens of the eye to change its shape for focusing is called (a) astigmatism (b) dilation (c) accommodation (d) nictation.
- 12 A centimeter (a) crawls on many legs (b) is a small French coin (c) equals about two fifths of an inch.
- 13 Carbon monoxide, the poisonous gas of auto exhausts, (a) smells like burning rubber (b) can be detected by an aroma like clover (c) has no odor.
- 14 Cutting an ordinary horseshoe magnet in half will (a) give you two magnets (b) destroy its magnetism (c) produce a shower of electric sparks.
- 15 To provide us with correct time, scientists observe the (a) sun (b) moon (c) stars (d) tides.
- 16 The element cobalt is (a) a lustrous silvery metal (b) a blue pigment (c) a pungent, irritating vapor (d) of unknown appearance, since no one has ever isolated it.
- 17 To draw a triangle containing three right angles, you would need, (a) a mirror (b) a sheet of graph paper (c) a sphere (d) a magician's wand.
- 18 As you ascend a mountain in a car, the tires will (a) get harder (b) get softer (c) spring leaks.
- 19 The milky fluid obtained from rubber trees is called (a) kelp (b) latex (c) gumbo (d) sisal (e) agar-agar.
- 20 The length of the yard was originally established by (a) the height of a candle that would burn from sunrise to sundown (b) the longest distance a grasshopper could jump (c) the length of King Henry I's arm (d) one ten-millionth of the distance from the equator to the pole.

Now YOU Ask One!

SEND us some interesting and amusing questions. We will pay \$1 for each one accepted. Submit as many as you like, but none will be returned. Address Question Bee Editor, POPULAR SCIENCE MONTHLY, 353 Fourth Ave., New York City.

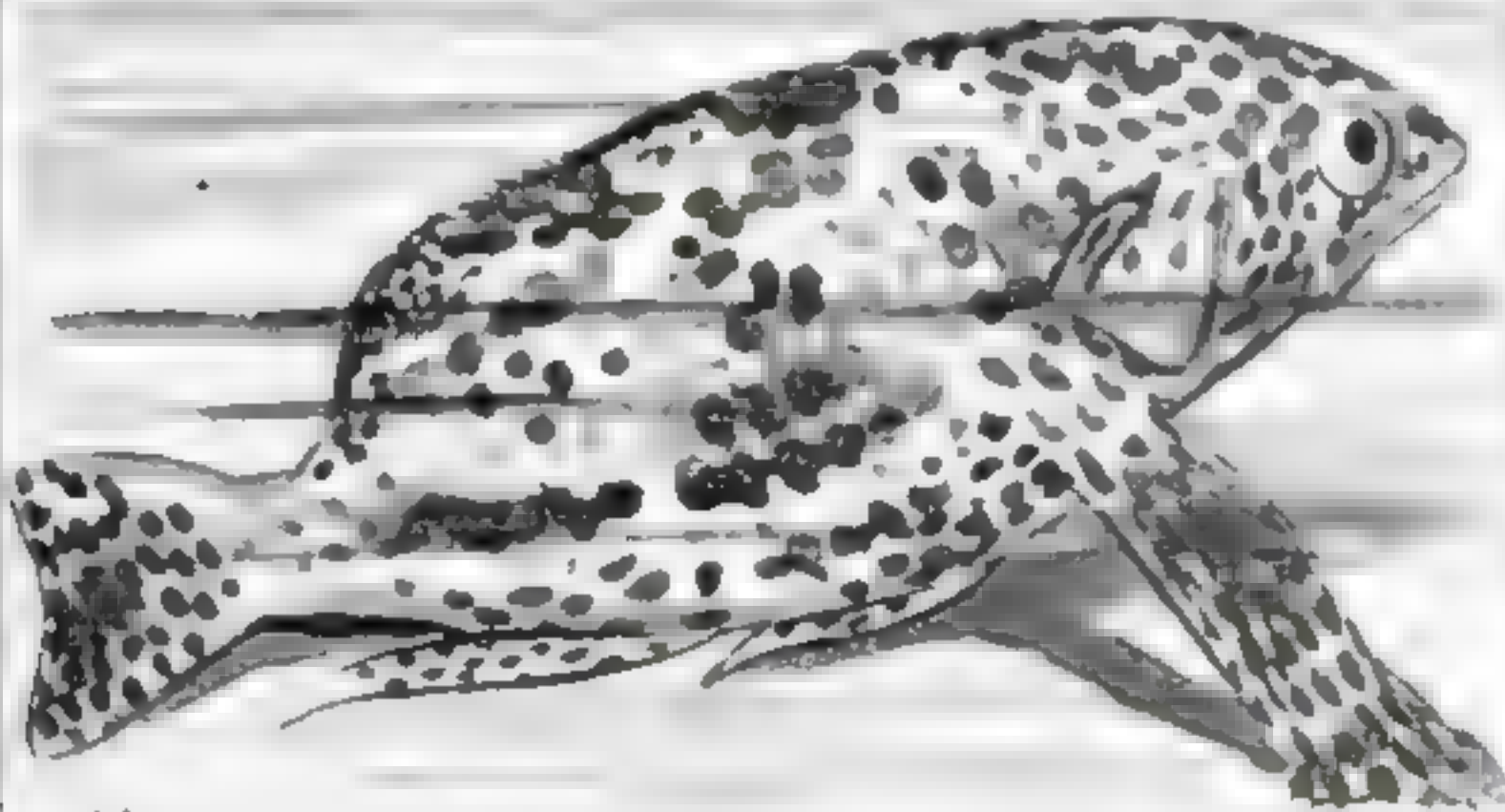
Un-Natural History

By
Gus Mager



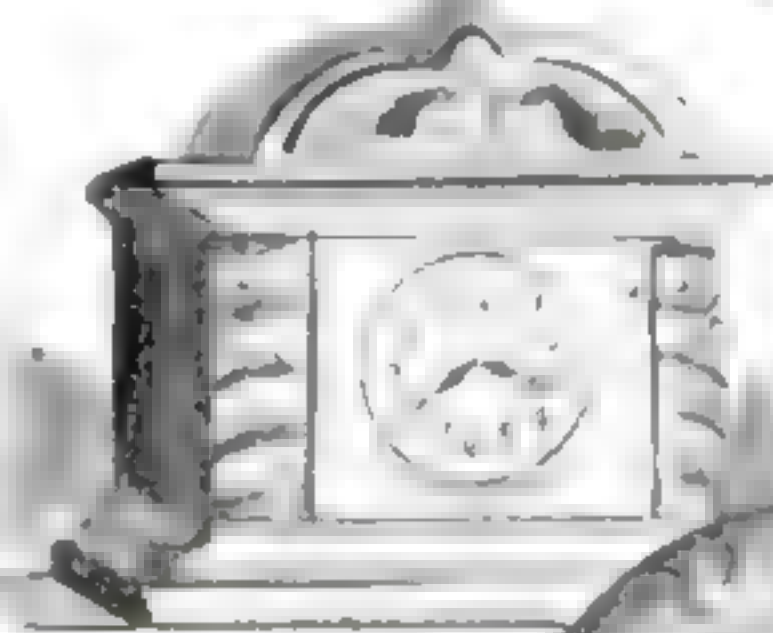
THE **GIANT KINGFISHER**, OR "LAUGHING JACKASS" OF AUSTRALIA IS CALLED THE **BUSHMAN'S CLOCK**! IT LETS OUT ITS DIZZY WHOOPS EXACTLY AN HOUR BEFORE SUNRISE AT NOON, AND AT SUNDOWN!

SLENDER AND HARMLESS-LOOKING, THE AFRICAN **MAMBA** IS ONE OF THE WORLD'S DEADLIEST SERPENTS! DURING THE MATING SEASON IT WILL ATTACK HUMANS AND CAN OUTFRAN A MAN!

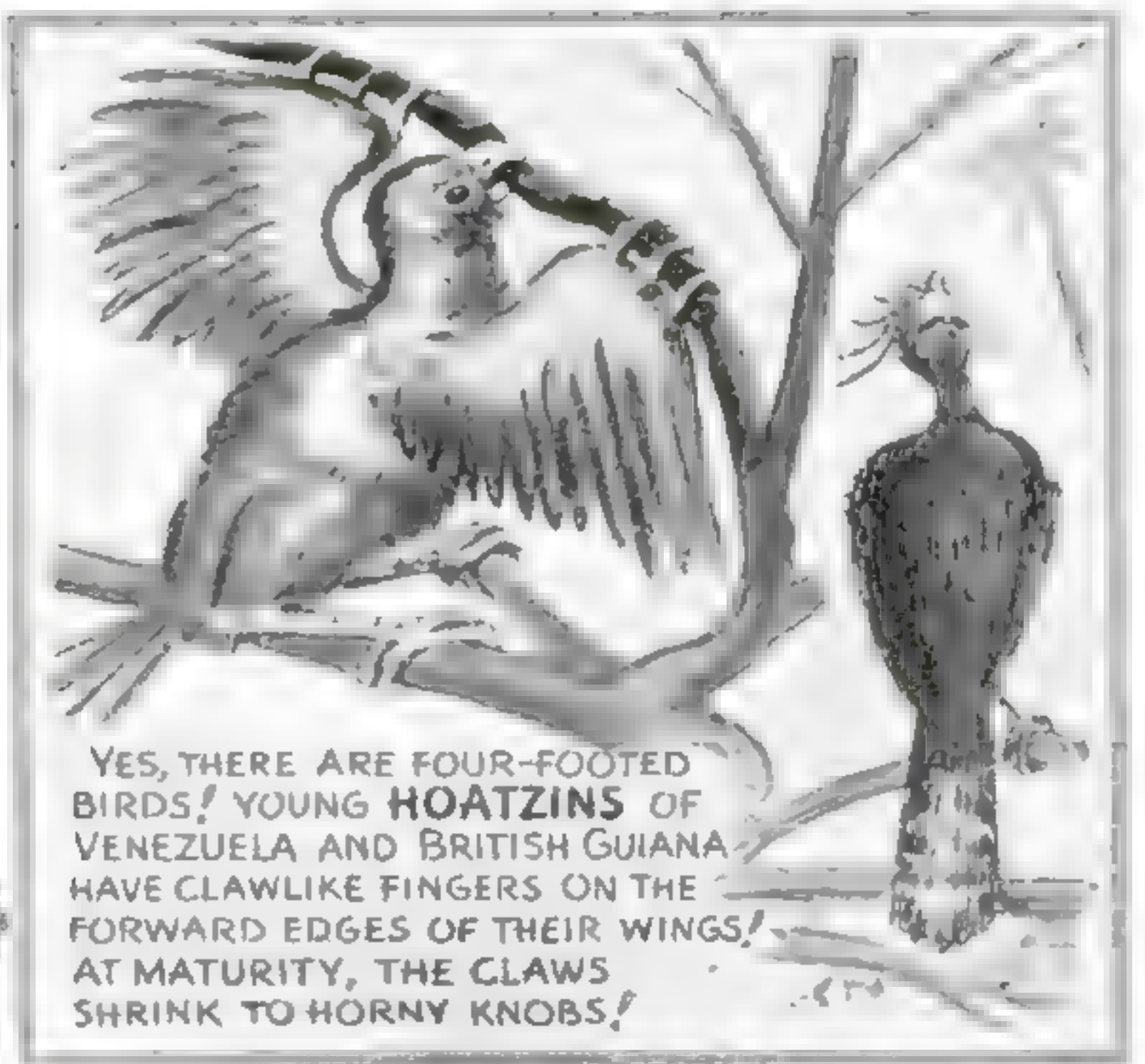
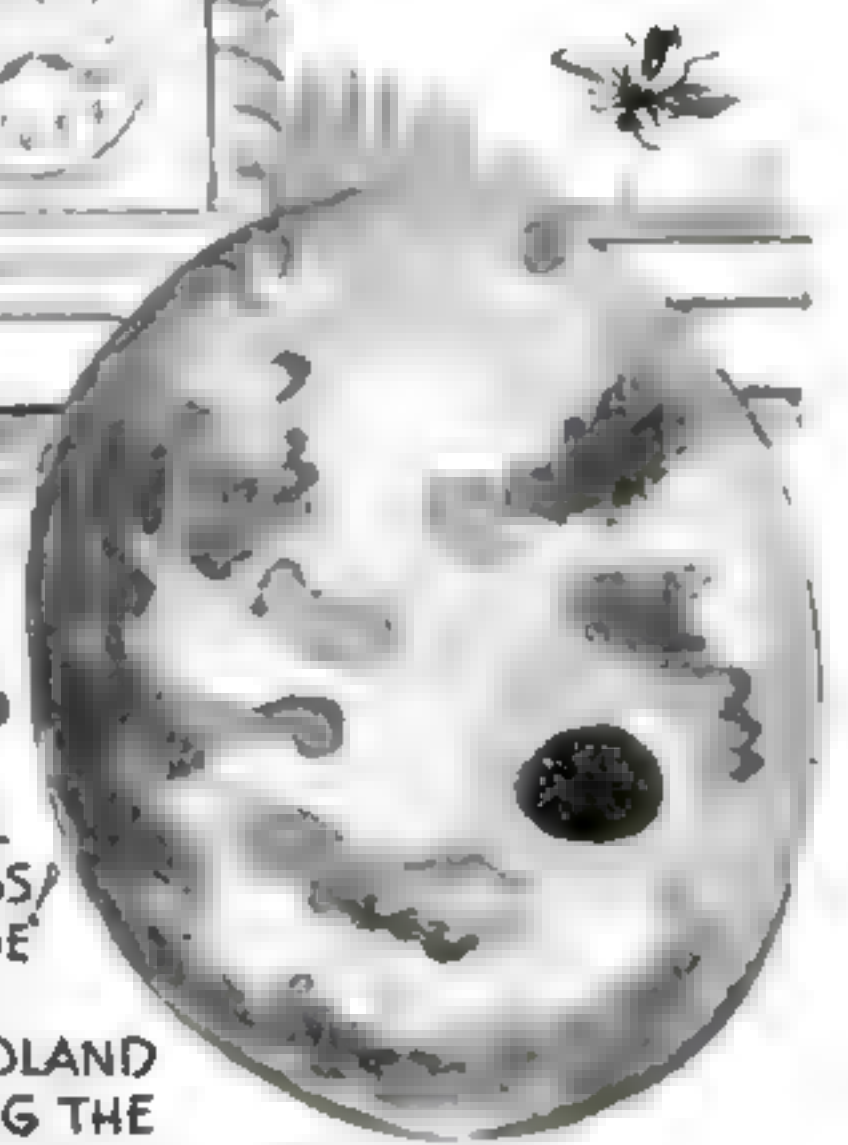


"AS USELESS AS FEET ON A FISH" DOESN'T APPLY TO THE SOUTH SEA **GROUPE**R! THESE FISH USE THE TIPS OF THEIR FRONT FINS AS FEET!

ARMIES OF TRAVELING **CATERPILLARS**, ESTIMATED TO BE EIGHTY MILES LONG AND THIRTY MILES WIDE, HAVE BEEN KNOWN TO STOP TRAINS IN AUSTRALIA AND NEW ZEALAND!



WASPS INSTINCTIVELY CAMOUFLAGE THEIR NESTS TO LOOK LIKE THEIR NATURAL SURROUNDINGS! BUILDING INSIDE A HOUSE, THEY STILL USE WOODLAND COLORS, MAKING THE NEST ALL THE MORE CONSPICUOUS!



YES, THERE ARE FOUR-FOOTED BIRDS! YOUNG **HOATZINS** OF VENEZUELA AND BRITISH GUIANA HAVE CLAWLIKE FINGERS ON THE FORWARD EDGES OF THEIR WINGS! AT MATURITY, THE CLAWS SHRINK TO HORNY KNOBS!

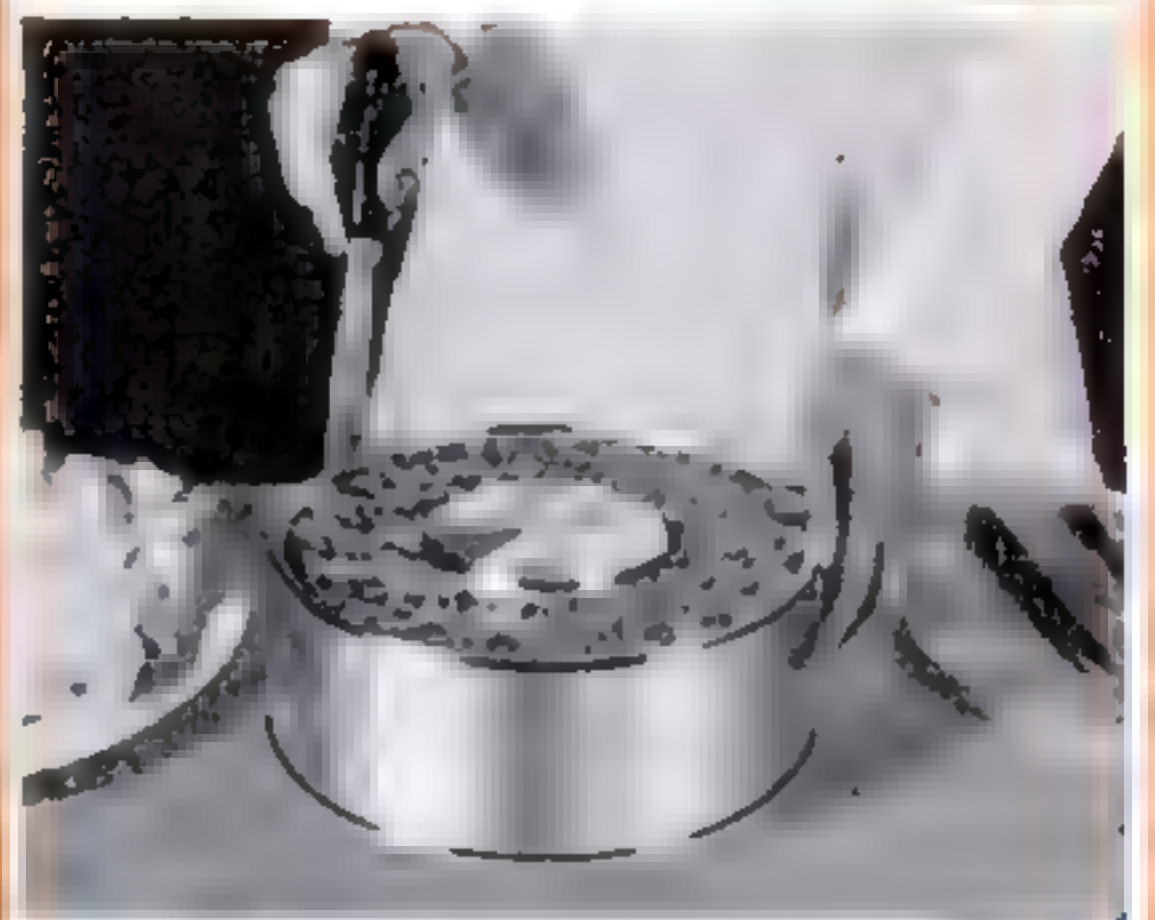
Handy Aids for



This indicator shows correct settings for fabrics

WRINGER PRESSURE for the safe handling of various fabrics is provided accurately with a control that is featured in a new-type washing machine, seen in operation at left

MOLDED DESSERTS and salads are easily removed from the mold shown below. After edges are loosened with a knife, the mold is inverted over the serving platter and warm water is poured in it, releasing the mold



SKIRT MIRROR. Sliding out of a groove in the back of a wardrobe chest, a mirror gives a view of the skirt

REVERSIBLE CHAIR. Two chairs are combined in the odd piece of furniture seen at the right. One seat and back are cloth-covered, the other leather-covered. The upside-down chair is said to have double the lifetime of an ordinary chair



KEG FOR ICE CUBES

Molded from soft, expanded rubber, the container above is said to keep ice cubes from melting for a period of twelve to fourteen hours



SOAP HOLDER

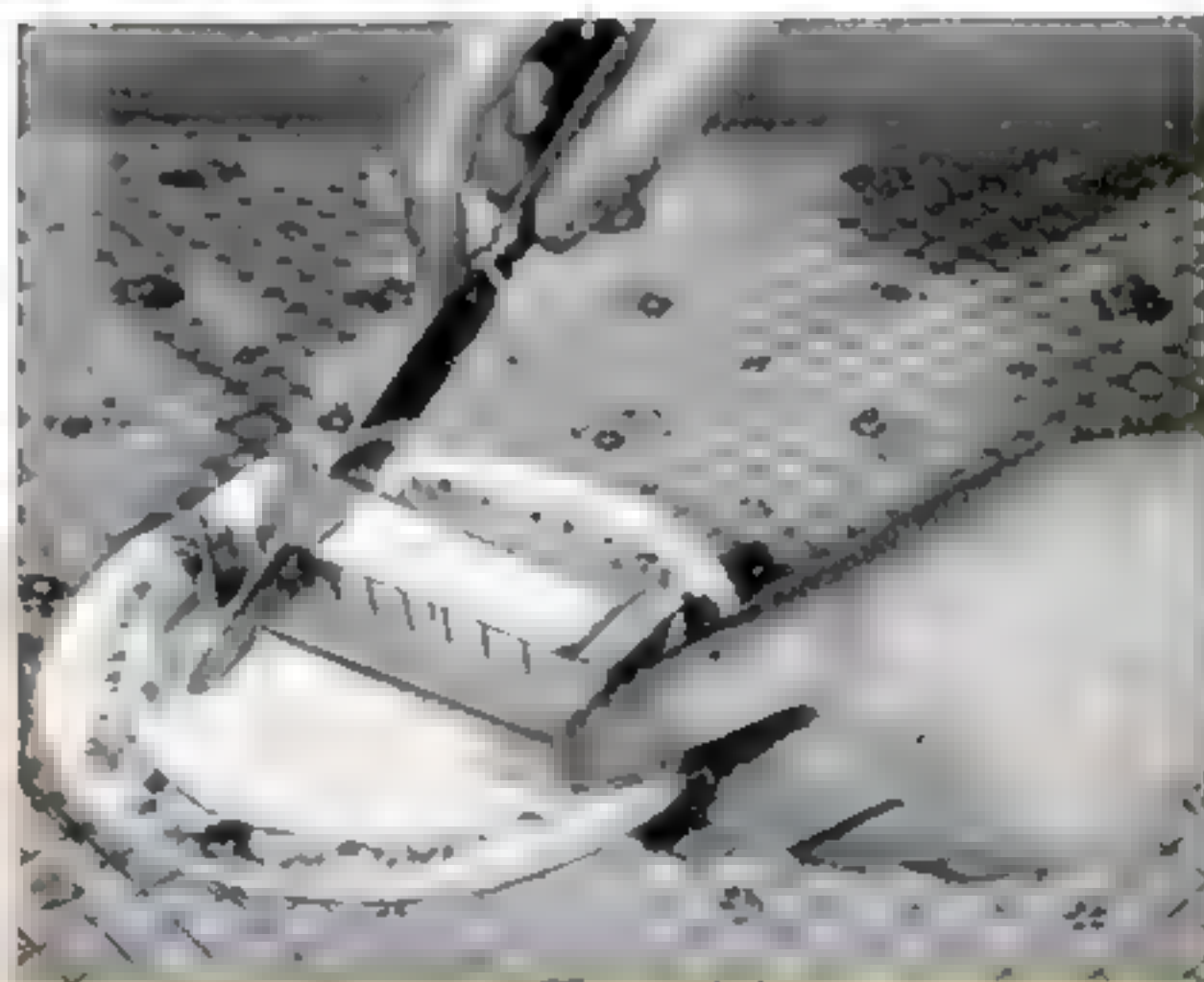
Dishwashing soap is always at hand in this porous bag, which is chained to a spring standard set on the edge of the sink by means of a vacuum cup. When the bag is released, it snaps back where it is out of the way



TEA IS SERVED with less bother when the cups and saucers are carried in this handy rack. It holds six cups, with the saucers on a shelf at the bottom

BUTTER GAUGE

Print or bulk butter is measured for cooking by the stainless-steel gauge seen at the right



A Bargain from Gus

"NOTICED," Joe Clark remarked when Gus Wilson, his partner in the thriving Model Garage, came into the office, "that old Silas Barnstable had his car in the shop this morning. First time he's been around to see us since you showed him why his horn tooted every time he pulled on his emergency brake, isn't it? What was his trouble this trip?"

Gus laughed. "The old skinflint drove his bus in all right," he said, "but he drove it out again without our being able to do any business."

"How come?" Joe wanted to know.

"Because he wouldn't do business our way, and I wouldn't do business his way," Gus said. "You know what we decided on when we started, Joe—that we'd do honest jobs and charge prices that would give us an honest profit on them, and that we'd charge every one the same price for the same job."

"Right!" Joe agreed. "That's what you might call the corner stone of our business."

"Old Silas came into the shop in a pretty sour sort of humor," Gus went on, "and said that his oil-pressure gauge wasn't working and that his engine was overheating. That was easy to check on, and I soon found that he was right on both counts.

"As the overheating wasn't serious, and as he has driven that bus of his only a few thousand miles, I figured that the chances were that something had gone wrong with his oil gauge. To make certain, I took it off and put on a new one. But the indicator of the new one didn't move any more than the indicator of the old one had. So I checked the firing order, the timing, and the water pump, but didn't find anything wrong.

"All the time that I was working on his car, old Silas was buzzing around me, asking fool questions and making fool suggestions, and growling about me holding him up when he was in a hurry. I told him that I couldn't do anything to remedy his trouble until I found out what it was, and that it probably was either in his oil pump or in an oil line that had broken or clogged, and that he'd have to hold his horses while I dropped the oil pan and checked on it.

"Then he wanted to know how much the job was going to cost him, and I said that I couldn't tell him anything about that until I had found out what was the matter. That set him to growling about garage prices and

how he had been skinned again and again, and to telling me about some cheap place down in the city where they did repair jobs for less than half what anyone up this way charges. By that time I'd had more than enough of him, so instead of dropping the oil pan I took off the new oil gauge and put his old one back on.

"There's your car, Mr. Barnstable," I told him, "in exactly the same condition it was in when you drove in here. You'd better take it down to that shop in the city you've been telling me about. Maybe they'll do business your way. We won't!"

"That sort of took the wind out of the old cuss. He hung around for a few minutes, and



The noise that the engine made was terrific. Con-

I got the idea that he'd just been trying to beat me down a dollar or two. But I got very busy on another job and didn't pay any more attention to him, and pretty soon he climbed into his car, snarled something about he'd 'show' me, and drove out."

"You did right, of course," Joe said, although a little doubtfully. "But I do hate to lose a customer."

"Me too!" Gus agreed. "But maybe we haven't lost old Silas. I've got a hunch he'll be back before long. I hope so, anyhow—somehow I sort of like the old grouch, and he's usually good for a laugh!"

But Silas Barnstable didn't come back that day, or the next day, or the day after that. "Guess we've lost him," Gus had to admit. "I suppose he got a cheap job done down at that place he was talking about."

The days stretched out to a couple of weeks, and Gus and Joe had almost forgotten about their grouchy client when, one rainy afternoon, Silas drove into the shop.

He's a dried-up little old man, and when he hopped out of his car and ran his bony, work-

Silas Barnstable Learns About Cut-Rate Garages

By
MARTIN BUNN

twisted fingers through his scanty gray hair he looked like an ancient and slightly embarrassed bantam rooster. "Hey!" he squeaked, looking at Gus.

"Hi!" Gus said, laughing. "What's the matter now?"

"This dam' automobile of mine—that's what's the matter!" Silas said. "It's knocking itself to pieces. Jest listen to it, will you? Sounds like a boiler-plate factory!"

Gus listened as Silas raced the engine. "It is a little bit noisy," he agreed. "But what did you expect? There was something the matter with your oil system when you were in here two weeks ago. It stands to reason that the trouble is worse now."

"Tain't!" Barnstable said briefly and tartly. "What was the matter then was just what you said it was—the oil pump. But it ain't that now—I've got a new oil pump. Got it downright reasonable, too. That shop down in the city I was telling you about only charged me five dollars—for the new pump *and* labor. Hey, mister—don't stand there staring at me like I'd stole something! Jest because a feller's got a few dollars laid by ain't no reason why he shouldn't take a bargain when he can get one!"

"No reason at all," Gus said. "Five dollars was cheaper than dirt for that job. A whole lot cheaper than we would or could have done it for you. . . . That being the case, I don't quite see why you brought your bus back here."

"I like to do my tradin' close to home, when I can," Barn-



necting-rod bearings knocked, a main bearing pounded, wrist pins clattered

stable explained. "You go ahead and see what's the matter with my car. Now that I've showed you that I can do pretty well somewhere else, I guess mebbe you'll be more reasonable."

"Oh, all right," Gus said good-humoredly. "Let's see—is your oil gauge working now?"

"Course it's working. Better than it ever worked before," Silas said. "Step on her and you'll see."

Gus got into the car and stepped on the accelerator pedal. As his foot went down, the indicator needle on the oil-pressure gauge jerked up to 30—to 40—to 50. The noise that the engine made was terrific. Connecting-rod bearings knocked, a main bearing pounded, and a half dozen wrist pins clattered. Old Silas regarded the hood of his car with undisguised apprehension. "Sounds like the hammers of hell!" he said in an awe-struck voice.

"Sure does!" Gus agreed as he got out. "Now let's have a look at the engine."

When he raised the hood, the first thing that caught his eye was the oil pump. It had been shined up a bit, but it certainly was far from new, and it looked exactly like the one that had been on the car two weeks earlier.

Then Gus noticed something else—a long, thin spring attached near the carburetor end of the accelerator rod, and running up into the cowl. "Watch your oil-gauge needle," he told Silas. Then he took hold of the spring, and pulled gently toward the carburetor. "What happened?" he asked.

"Why," Silas told him, "the needle went up to 50."

Gus laughed until old Silas glared at him—and then he laughed some more. "What's the joke?" Barnstable demanded grumpily.

"The joke's on you," Gus said. "On you—five dollars worth. Just wait a minute now, and I'll show you something."

He detached the spring from the accelerator rod, and then carefully removed the oil gauge from the instrument panel. The long, thin spring came with it.

GUS took the gauge over to his workbench, and began to take it apart. "Now you watch!" he told Silas. "See how one end of that spring is attached to the needle arm of the gauge? The other end was fastened to the accelerator rod, near the carburetor. See that little elastic band on the other side of the needle arm? That was put there to keep the needle at zero until you stepped on your accelerator pedal. When you did step on it, the pull of the spring made the needle move, and the farther down you pressed the accelerator pedal, the farther up the scale the needle moved. They adjusted it so that when you were driving at average speed the indicator showed just about the pressure that is normal for your car."

"Huh?" demanded old Silas, beginning to look worried. "What's this all about? I don't see what you mean."

"I mean that you've been gypped!" Gus said. "Those cheap birds you took your car to didn't put on a new oil pump, and probably they didn't even check your oil system. They didn't do anything at all but clean up your old pump so that it would look new, and rig that spring onto your oil-pressure gauge, so that you would think that it was working. Your car is in exactly the same condition that it was in when you had it in here two weeks ago, except that it has been running without proper lubrication all that time. You thought that you were saving a few dollars, but maybe you've done ten times as much damage to your engine."

"I've been gypped, hey?" yelled Barnstable.

"I'll show those danged cheats! I'll have the law on 'em! By heck, I'll stand 'em a suit!"

"Go ahead—and see how much you get out of it," Gus told him heartlessly. "Well, now, what do you want me to do about your car?"

Old Silas hesitated for ten seconds. "I want you to fix it up right," he said at last. "Do it your own way—but jest remember that I ain't a millionaire!"

Gus checked the oil gauge, found it in perfect condition, and put it back on the instrument panel. Then he checked the crankcase, and found much too much oil in it. "When did you last buy oil?" he asked Silas.

"Not so very long ago, when I first noticed that my motor was getting too hot," the old fellow told him. "I had the crankcase drained, and put in six quarts."

"I'll have to drain it again," Gus told him. He took out almost three gallons. "This bus of yours is a regular oil refinery," he said. "It *makes* oil. You put in six quarts, and lo and behold I take out three gallons. . . . The only trouble is that this oil I've taken out is over half gasoline. That's the cause of your grief—somehow gas is getting mixed with your oil. I'll have to find out how."

He checked the oil pump, the fuel pump, and the carburetor, and found them all in perfect condition. Then he tipped his cap over his left eyebrow and scratched the back of his head while he did some heavy thinking. After that he began going over the gas line, inch by inch, as far as the pump. Then he started the motor idling and continued toward the carburetor. When he came to a place where the copper tubing of the gas line crossed the copper tubing of the outlet from the oil filter, just a few inches off the engine block, he leaned over and sniffed several times. Then he straightened up.

"Won by a nose!" he told old Silas. "Look here—I want to show you something that wouldn't happen" *(Continued on page 238)*

THE HOME WORKSHOP



In This Issue.. TOY BUILDING • MODELS • NEW SHOP IDEAS
PHOTOGRAPHIC HINTS • HOME LABORATORY • RADIO



YOU CAN HAVE
LOTS OF FUN
MAKING THESE

New TOYS

HOW many toys are you going to make for Christmas this year? A lot of them, we hope, because no home workshop activity gives greater satisfaction and pleasure. There is something imaginative and colorful about toys that sets them apart from ordinary shop projects. Then, too, there is the added joy of being able to give each toy to some child and share in his happiness. Home workers from coast to coast are rapidly coming to realize the truth of this. The National Home-workshop Guild has led the way, and its members alone constructed 50,000 toys last year. Of course, if you intend to turn out any quantity of toys, it is important to start early. For this reason we have brought together a variety of new designs for toys on these and the following pages.



The boxing game is an easy one to turn out in quantities because the principal operations are cutting dowels to length and drilling them

THE Masked Marvel and the Mallet-Head Kid take their places in the ring. There goes the gong! The fighters leap from their seats. Who will land the first blow? Will it end by a knock-out?

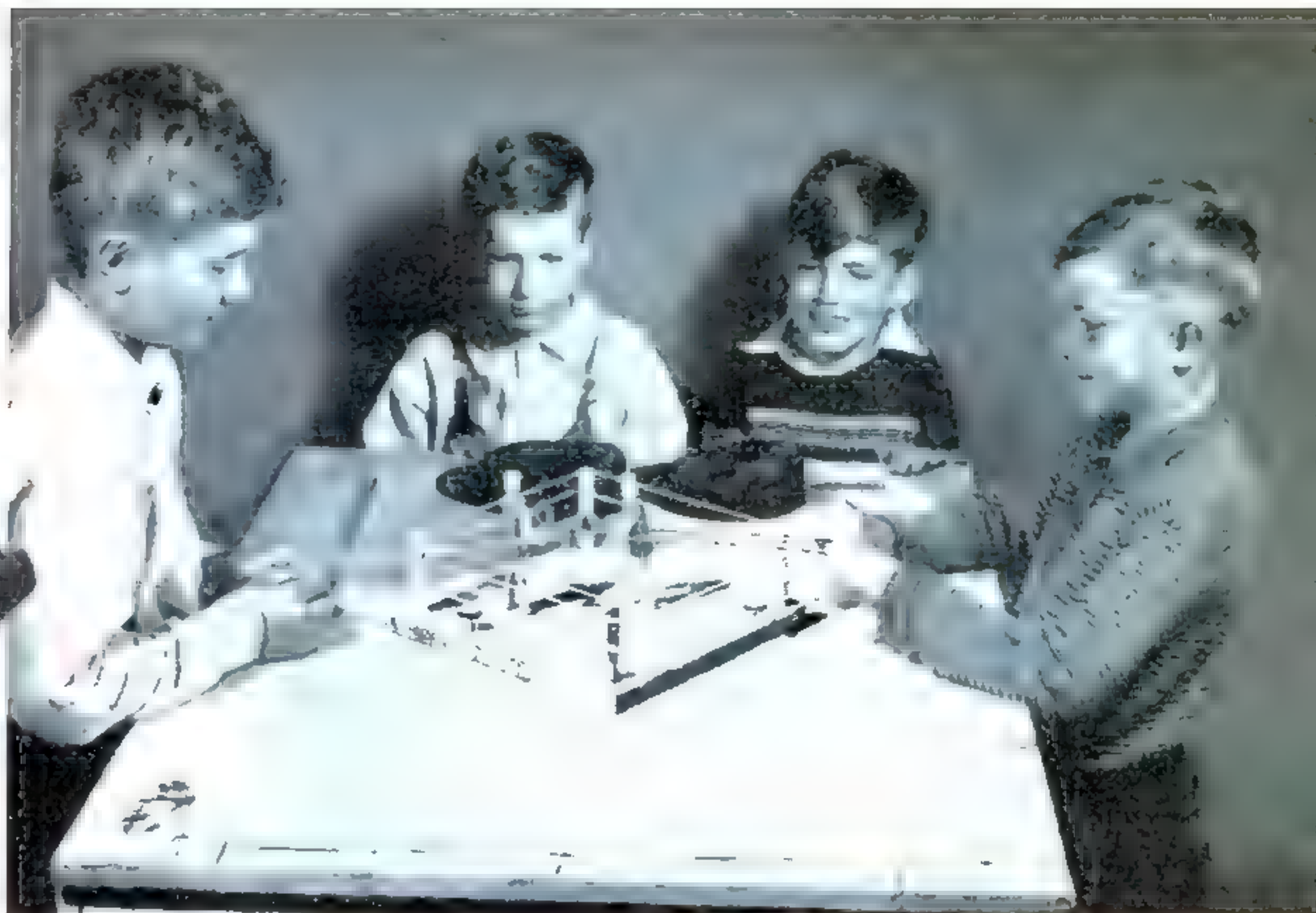
This is a new boxing game and toy combined. Most of the construction consists in cutting large and small dowels into short lengths, drilling holes, and assembling the parts with elastic cord.

The ring itself is merely a $13\frac{1}{2}$ " by $13\frac{1}{2}$ " piece of white pine about $\frac{5}{8}$ " thick. Plywood of the same thickness or pressed composition wood can be substituted, and the floor can be covered with canvas for added realism. Holes are drilled at each corner for $\frac{5}{8}$ " dowels, which should project about 4". Mason line or any heavy cord will serve for ropes, and it should be tied securely to each post. If you wish, slice narrow sections from a 1" dowel and set four pegs in each to form stools for each fighter's corner.

The head of each figure is a piece of $\frac{5}{8}$ " dowel; the neck, arms, and legs are $\frac{3}{8}$ " dowels, and the feet are thin slices cut from $\frac{5}{8}$ " dowels. A piece of 1" dowel or broomstick may be used for the trunk. The forearm joints are cut at 45 deg. At its juncture with the shoulder, the upper arm is cut or sanded to a slight angle so as to lift the arms away



The parts of each boxer are strung together on an elastic



The Battling Dawels

BOX LIKE LITTLE DEMONS

from the body, as can be seen in the photos.

Drill small holes through the length of each dowel and assemble them as you would a string of beads, using elastic cord. At the top of the head, the bottom of both feet, and the ends of each arm, small wood plugs must be inserted and cut off square. These will hold the ends of the elastic. An elastic which is almost loose will result in a figure that is very limber and quick to go into action, but if the elastic is stretched as much as possible, the figure will be comparatively rigid.

Purely for the sake of appearance, each figure should be fitted with boxing gloves cut from the soft leather of an old glove and glued in place. Bits of leather can also be glued on to form features for the heads; or you can use black paper in the same manner, or paint them with a small brush. Boxing trunks may be added.

Two 11" lengths of stiff fence wire are required for operating each fighter. One end of each wire is shaped into a loop. The wires pass through screw eyes near the top of each corner post, as illustrated, and the free ends fit into holes drilled into the ends of the dowels that serve as the



Here is the Masked Marvel ready for action. He is controlled by two pieces of stiff wire, the ends of which fit into holes drilled in the arms



A corner of the ring. Two small screw eyes are inserted near the top of the post as guides for the wires by which the boxing figure is moved



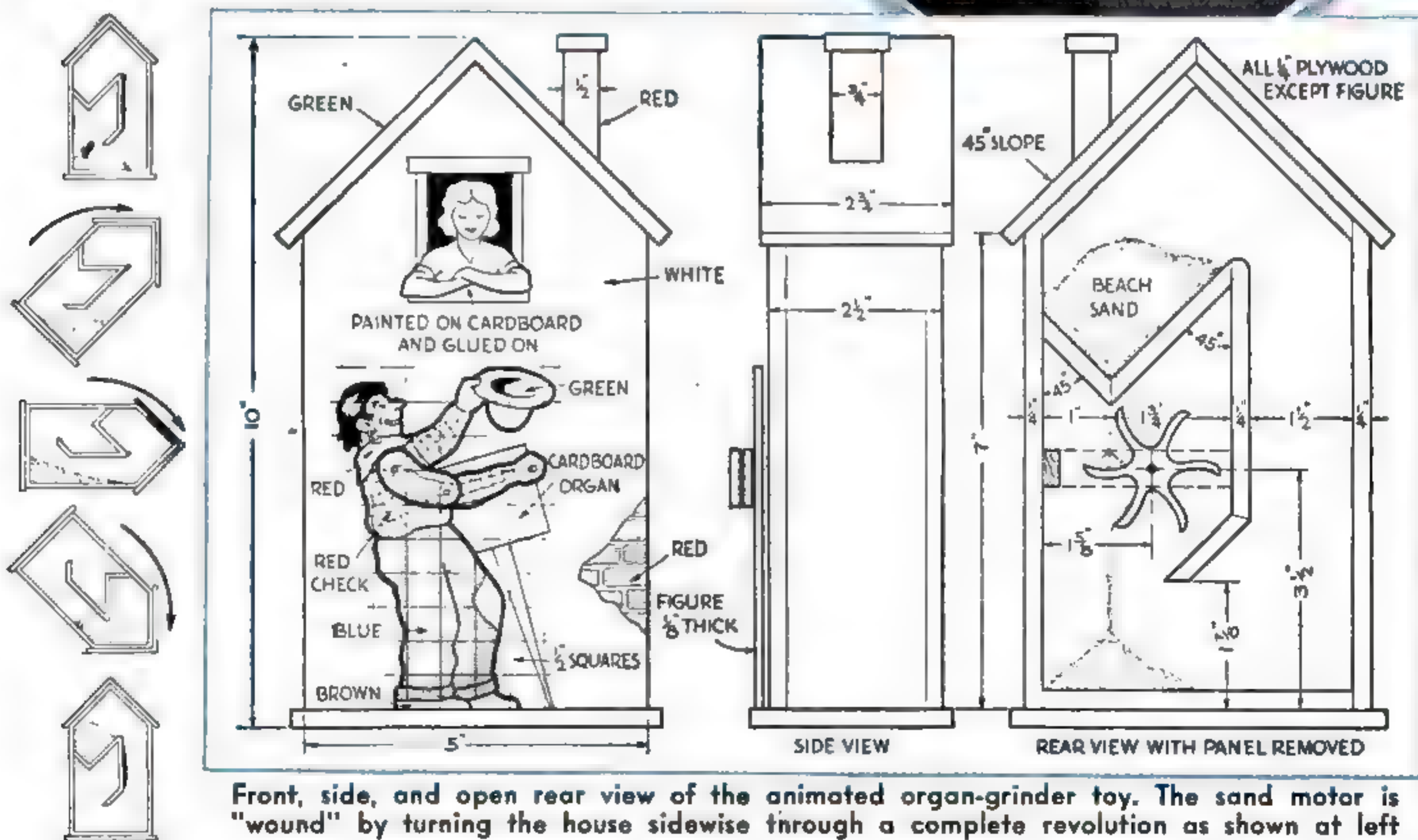
forearms of each figure. The wire controls should be grasped in each hand. In "managing" each fighter, all of the rules of the game should be observed. The controls are just long enough to permit one of the battling dowels to be knocked into a corner or into the ropes, but not long enough for either fighter to reach his opponent's corner. Knock-outs may, of course, be only technical, and the game is then counted on points, but it is also possible to assemble the figures so loosely that the plugs which anchor the elastic will pull out when the fighting becomes too furious. This adds much to the excitement and hilarity.

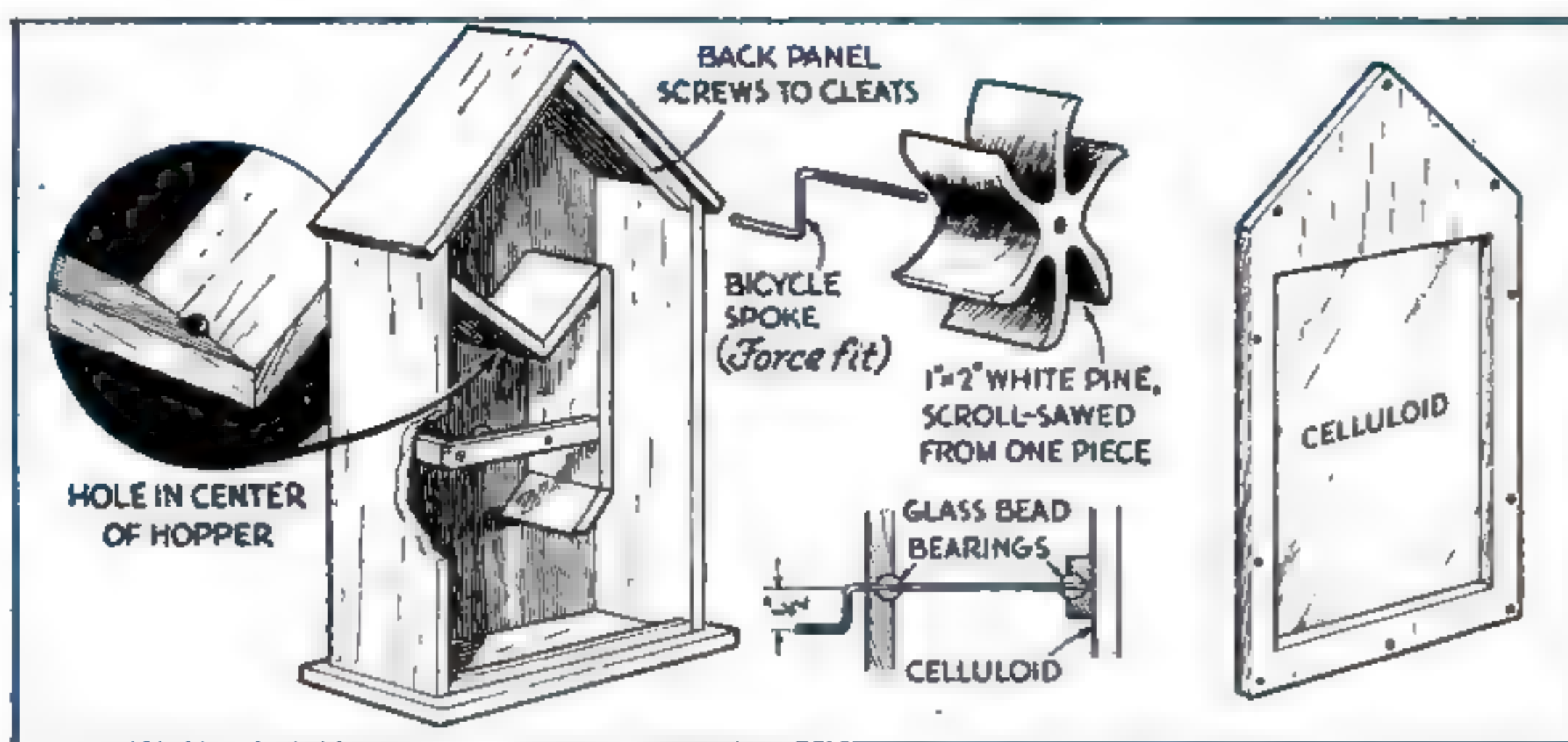
If these boxing toys are to be used as gifts, the main points of the game may be typed on sheets of paper and then glued to the underside of the baseboard.—KENNETH MURRAY.

Sand Motor Drives Organ-Grinder Toy

AN EVERLASTING sand motor provides the power to drive the mechanical organ grinder illustrated. To "wind up" the mechanism, it is necessary merely to give the box a complete turn in the direction indicated in the drawings. This brings the sand back into the hopper ready to run down and turn the small paddle wheel. Other adaptations will suggest themselves, such as a woman pumping water or a hobo sawing wood.

For the box, $\frac{1}{4}$ " plywood is used, the joints being well fitted to prevent leakage of sand. The six-bladed paddle wheel is scroll-sawed from a block of white pine. The axle is a piece of bicycle spoke turning in glass-bead bearings.

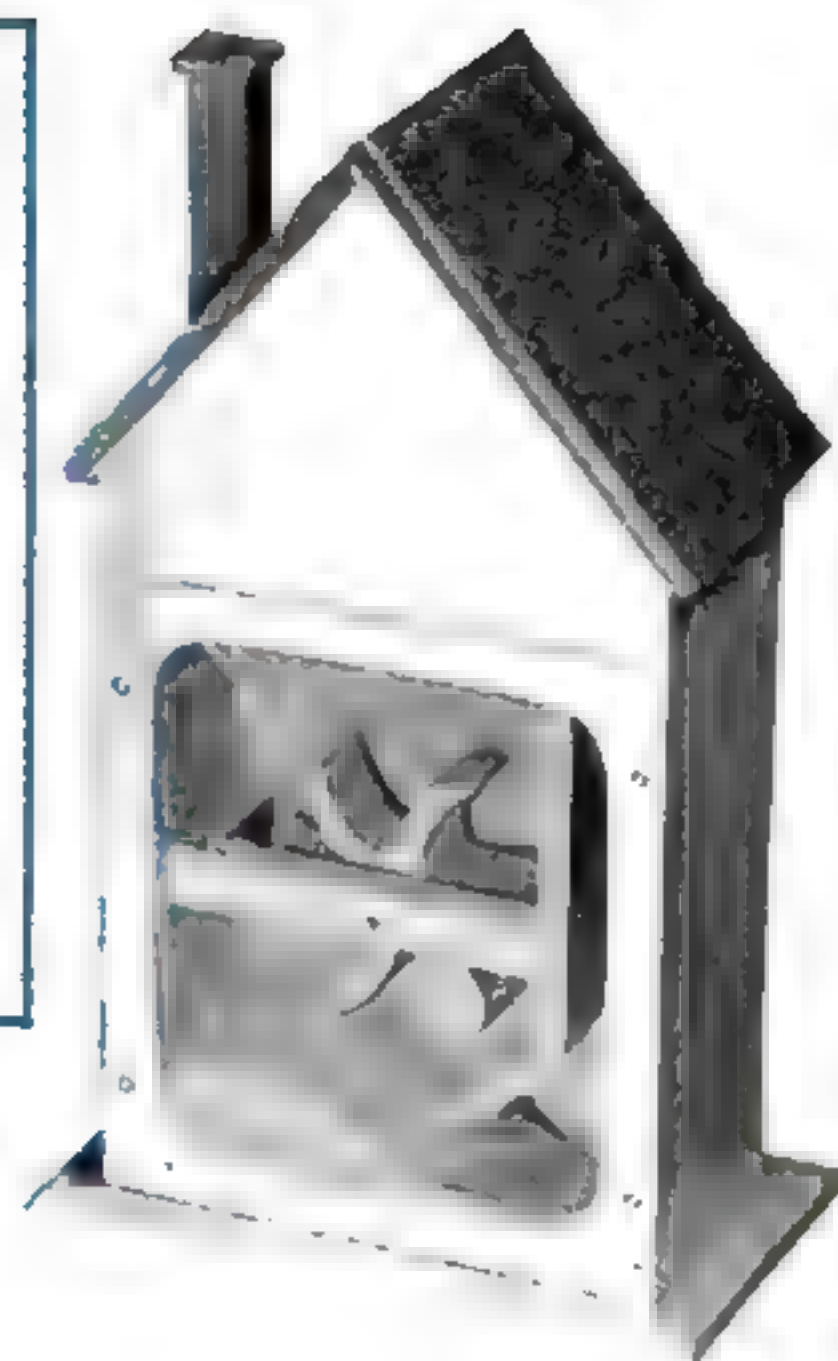




which are recessed into the wood as shown. Short lengths of brass tubing will serve just as well as the beads.

The hole in the sand hopper should not be over $\frac{1}{8}$ " in diameter for beach sand. Incidentally, beach sand is the best because the grains are smooth and pour more readily. Sand from a creek bed is also satisfactory. To facilitate adjustment, the back panel with the window is fastened with No. 3 screws.

The operating mechanism and a photo of the house with back in place



The organ grinder is scroll-sawed from $\frac{1}{8}$ " material and painted in bright colors. The girl is painted on cardboard, together with the window frame, and glued to the box, as is the hand organ.—L. R. BROWNE.

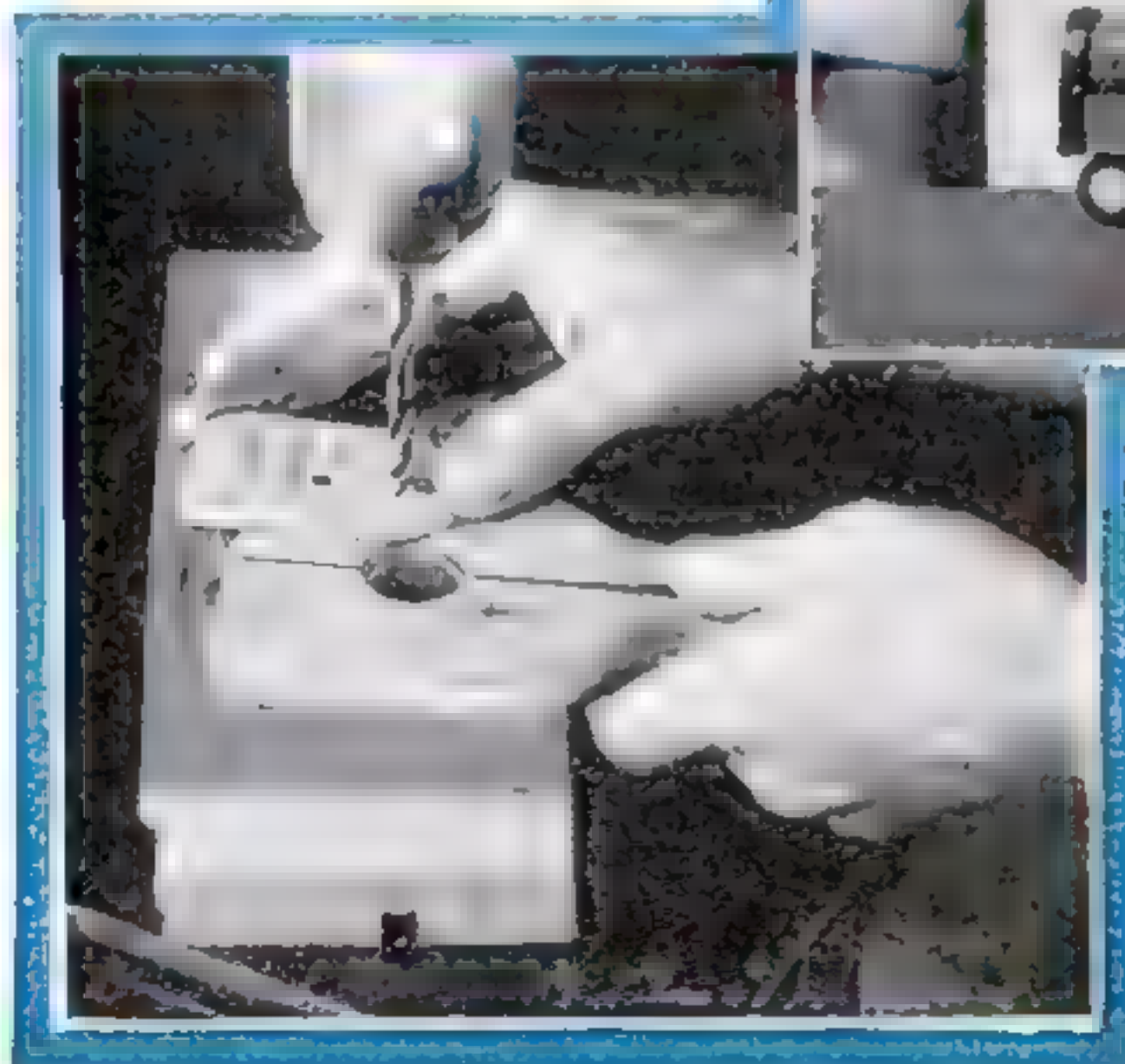
Toy Tractor Has Driver Who Keeps Moving

THE busy driver of this tractor pivots from side to side when the machine is pushed or drawn by a string. All details of construction are shown in the drawings on the following page.

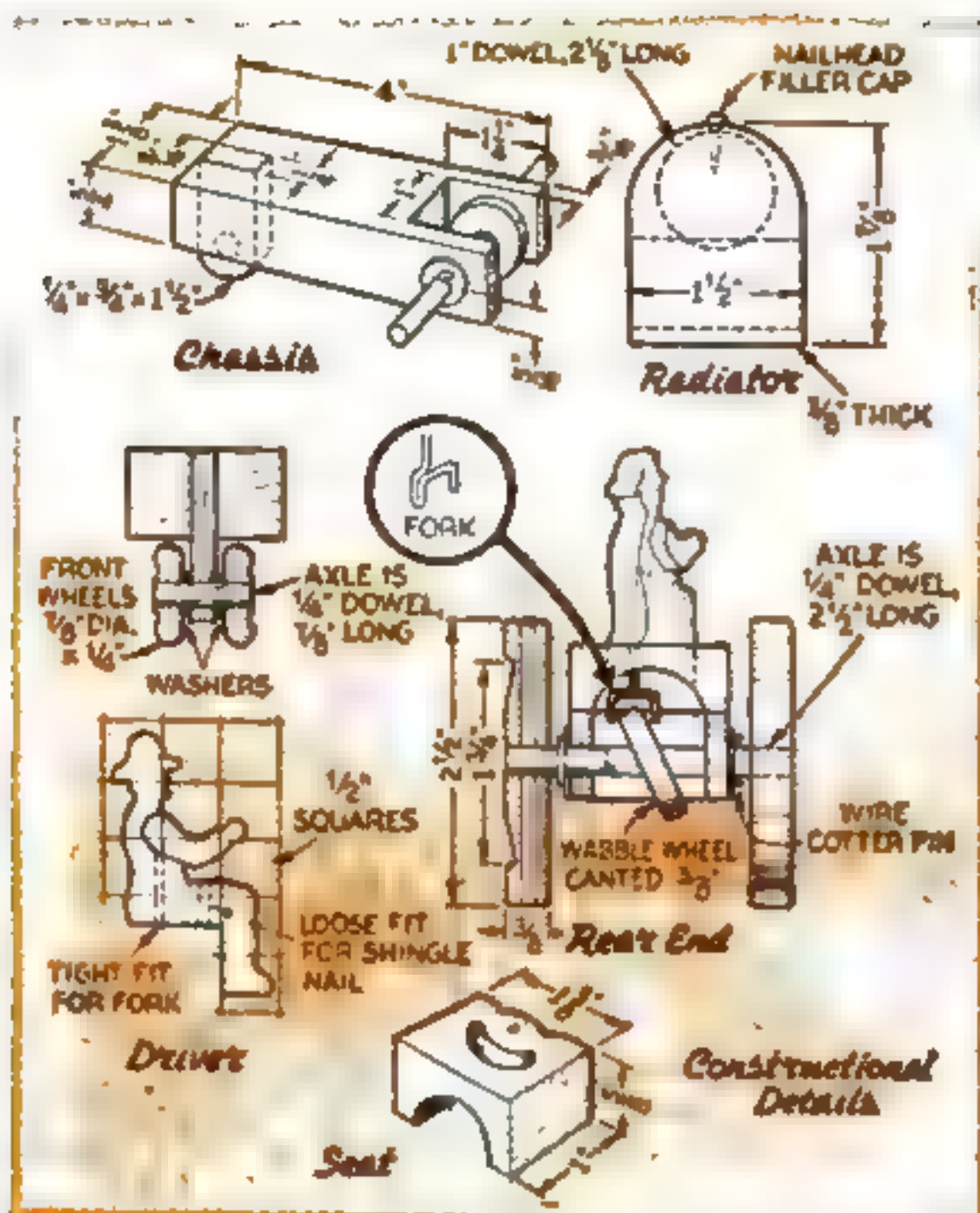
The wooden block that serves as the chassis is notched at the back for the animating mechanism, and in front for the wheel bearing. Bore the bearings oversize to allow free movement for the axles. The radiator is attached with two shingle nails.

Turn the rear wheels from plywood, the front from disks sliced off dowel stock. The wobble wheel is a similar disk, bored obliquely to give a sidewise cam movement. When assembling the rear end, use washers and wire cotter pins to limit end play, and glue on the wheels.

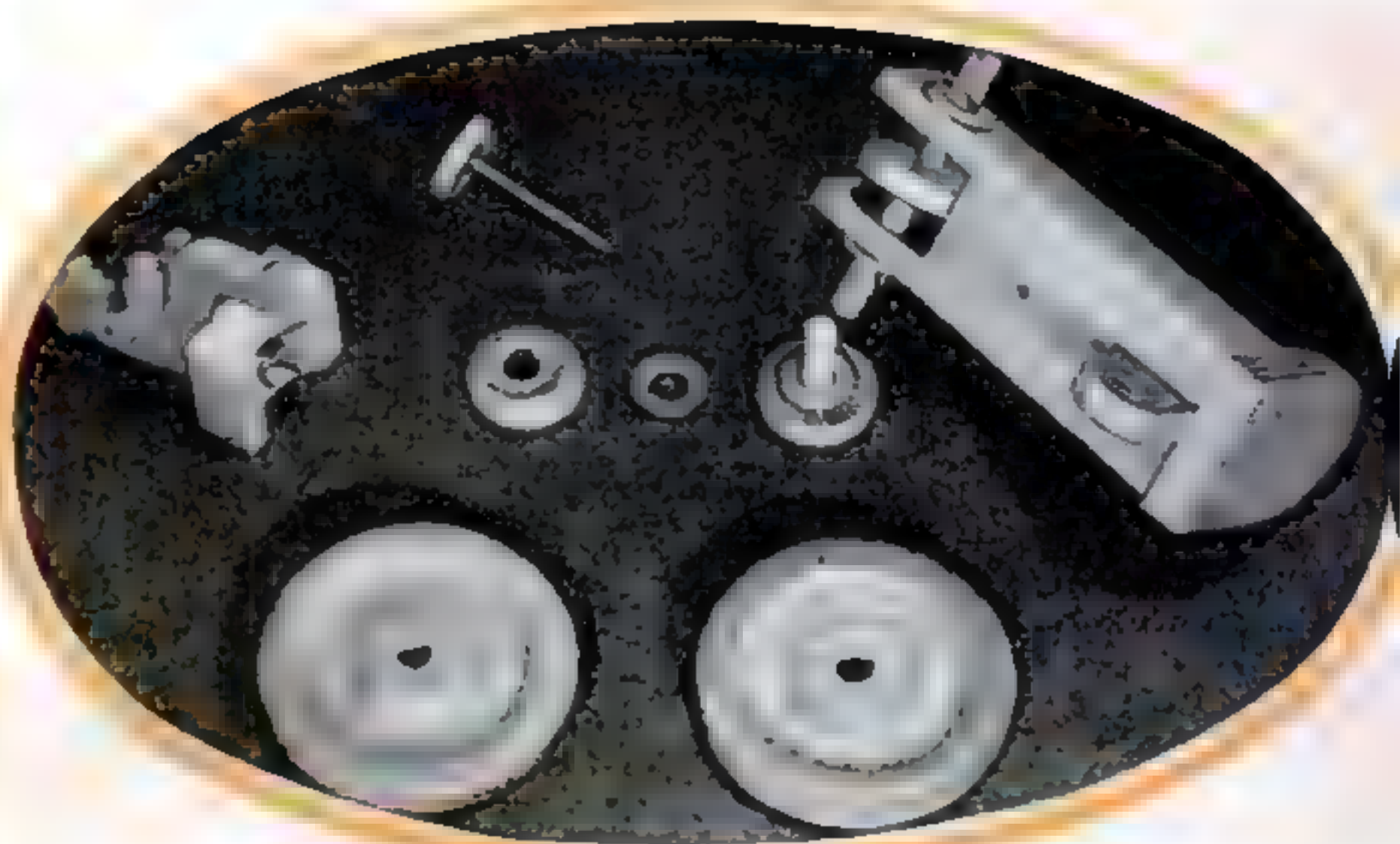
Arch the seat block to clear the wobble wheel and slot it for the wire fork projecting below the driver. Notch the front to clear the driver's legs. Pivot the man with a



Left, the wobble wheel is drilled in a plywood jig slotted so the handles may be sprung together. The disk is held obliquely by two nails driven into one side of the opening about $\frac{3}{8}$ " from the surface. The jig plate centers the hole



Details of the construction and, in oval, the set of completed parts. The wobble disk operates a wire fork, which turns the driver's body from one side to the other



shingle nail through his lap into the seat. Adjust the seat with the fork above the axle, and nail it on.

Paint the parts before assembling. Dipping is a convenient method, especially if a number of the toys have been constructed. The tractor illustrated has an orange body, yellow wheels, and black tires and radiator. The driver has pink face and hands, blue coveralls, and black hat.—EDWIN M. LOVE.

Walking Turtle Moves Its Head and Feet

WHEN pulled on a string, the wooden turtle illustrated below moves its legs and draws its head in and out in a lifelike manner.

Turn the shell from a band-sawed pine blank. Hold it in a chuck for recessing, and then fit the recess to another chuck for shaping the outside. Groove the segment zones and divide them radially.

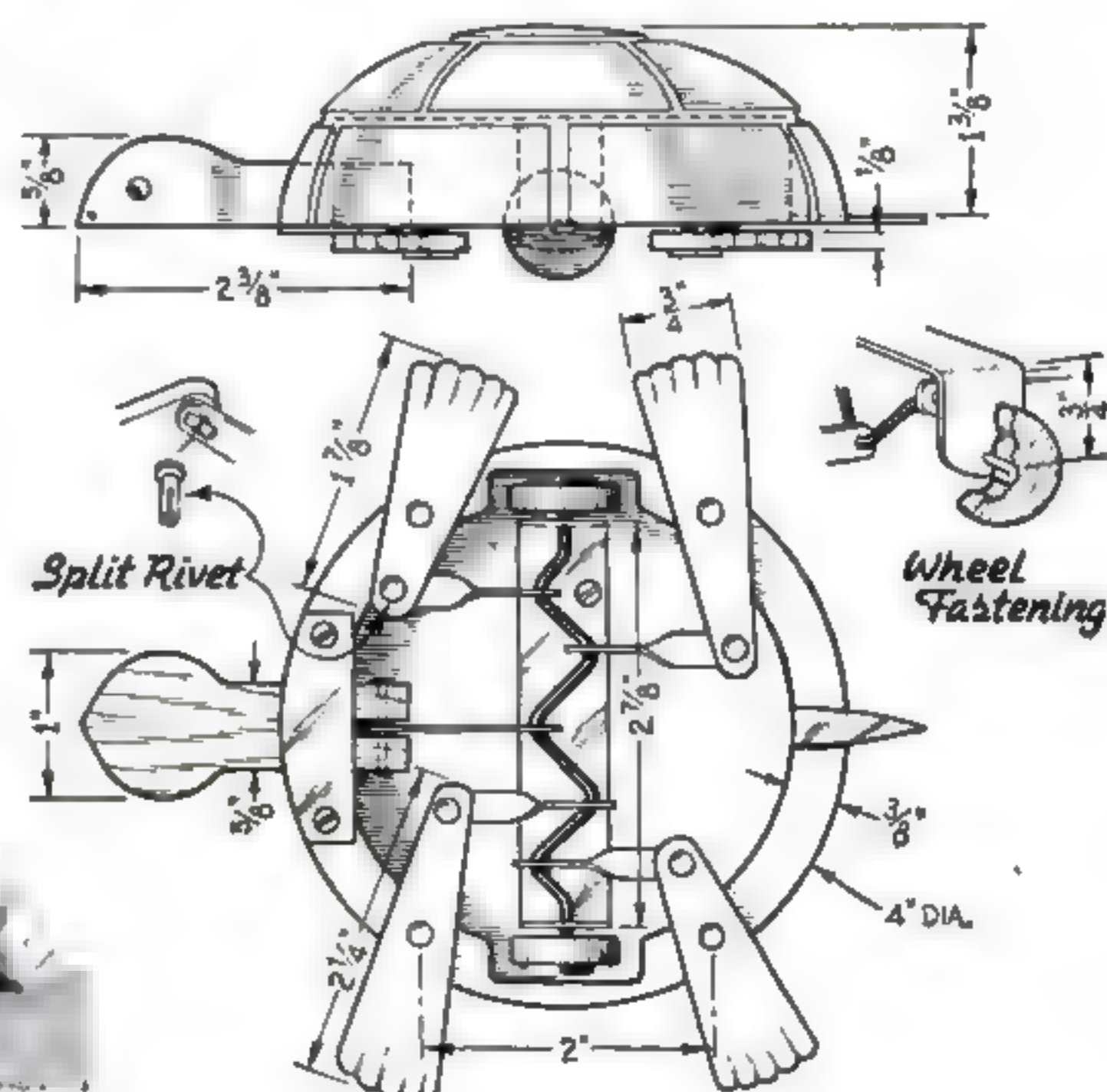
Bend the crankshaft from baling wire, the bearing from a strip of sheet iron. The connecting rods are strips of sheet iron, pushed

onto the cranks before the wheels are added. The latter are keyed by bending the shaft ends back on themselves and forcing them into small holes in the wheels, where a drop of celluloid cement holds them. Screw the bearing inside the recess, slit the ends to the bearing holes, and force in the crankshaft.

Shape the head and neck semicircular on top. The neck slides in a groove in the shell, being held with a metal plate. The connecting rod enters a slot, where a nail holds it. The tail is a strip of inner-tube rubber.



The turtle's head and feet are operated by a wire crankshaft, as in the bottom view



COLORFUL Toy Freighter

FOR QUANTITY PRODUCTION

BOATS are among the most fascinating toys for young children. If they can play with a boat in the bathtub or in a wading box or pool, so much the better, but they also get much enjoyment in playing with one on the floor if it is of a flat-bottomed type.

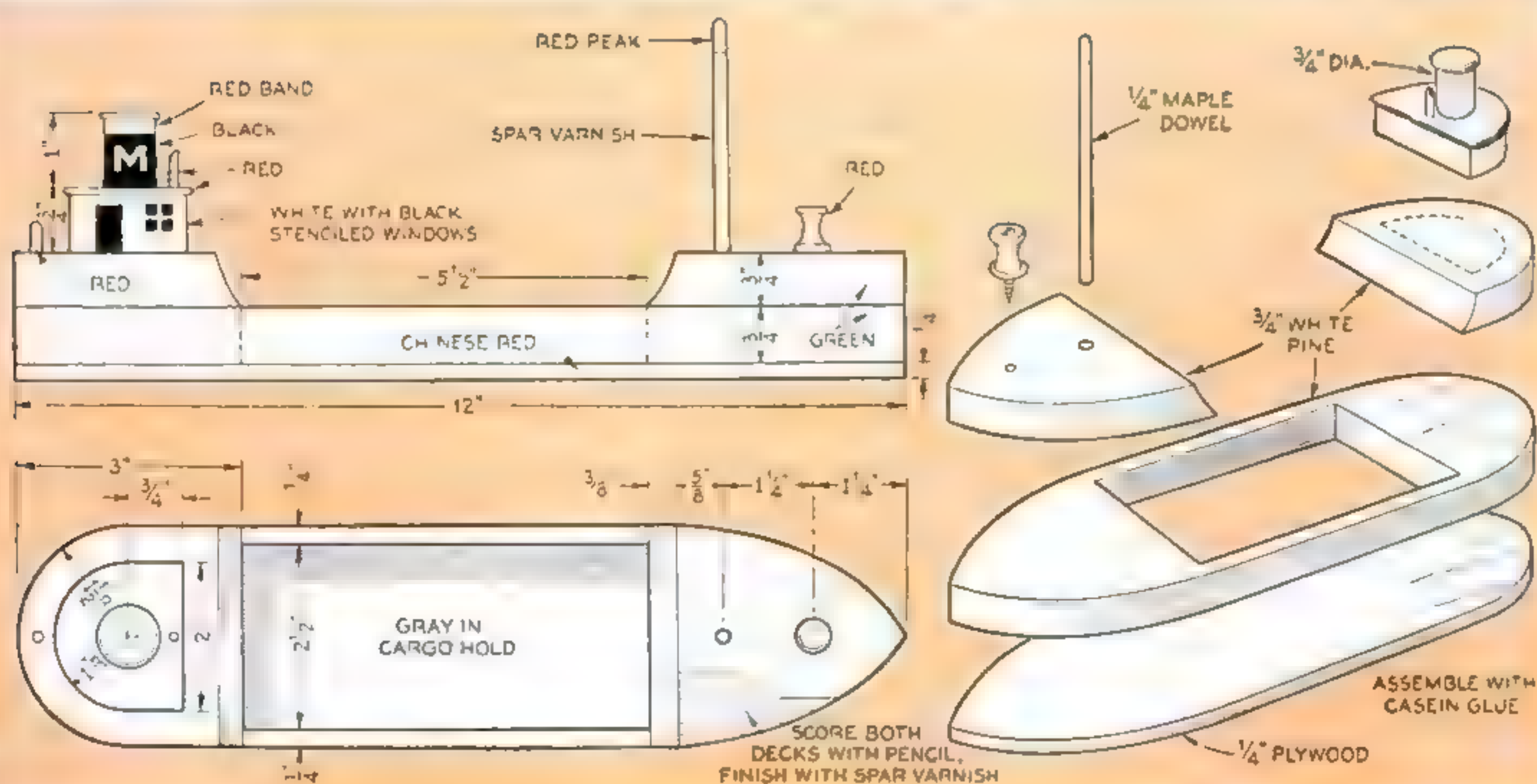
The little freighter illustrated is adapted for either purpose, and the design is especially well suited to quantity production because of its simple construction and the small amount of materials required. The capacious cargo hold will carry a large shipment of dummy boxes and barrels made from scraps of wood.

White pine, redwood, or any fairly light-weight wood may be used. The hull is built up as shown and fastened with casein glue to a waterproof plywood bottom. The plywood should be of the outdoor type. Avoid using nails or brads unless galvanized, because ordinary nails will eventually cause rusty streaks.

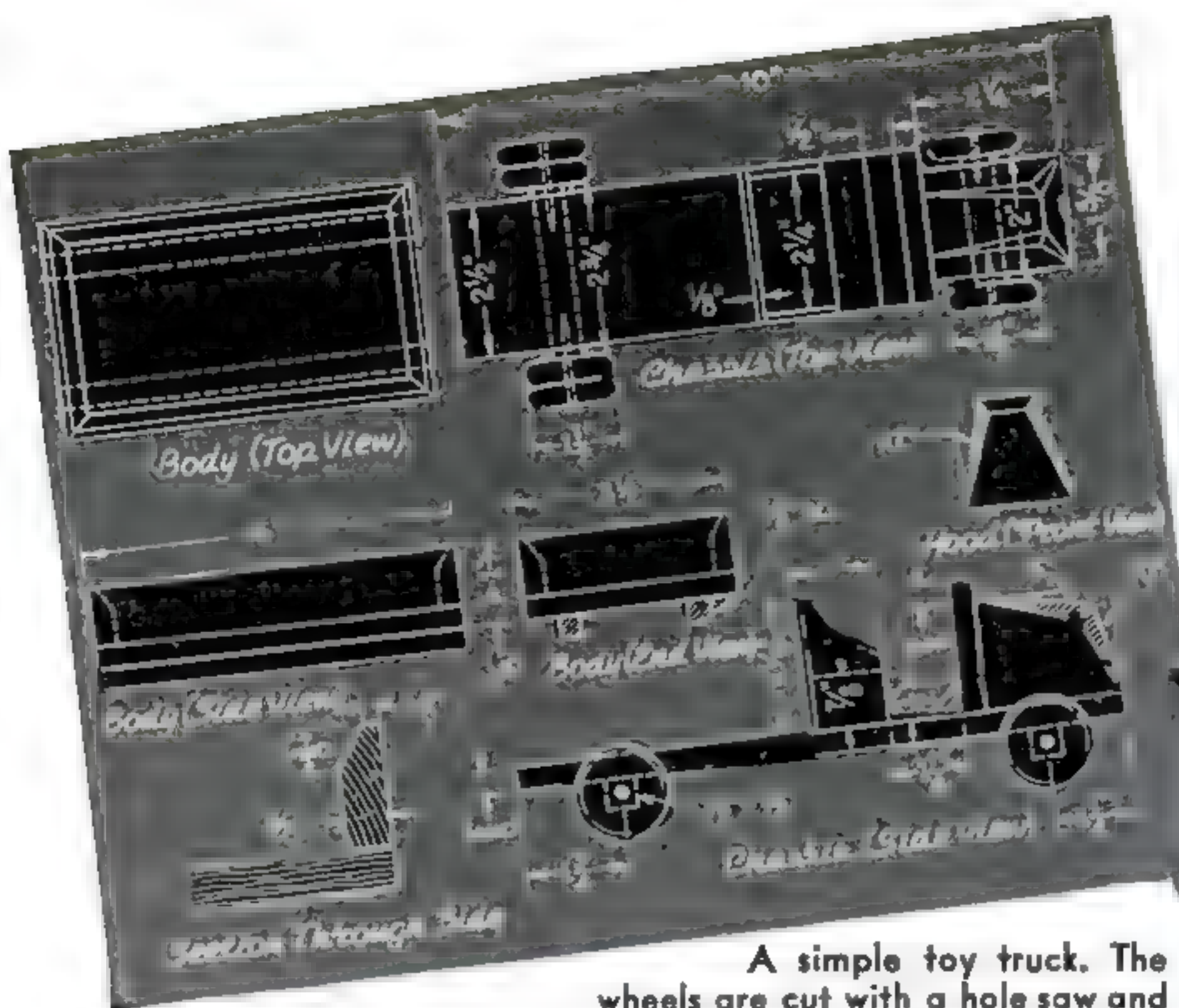
Deck planking can be simulated by scoring

the wood with a hard lead pencil and then varnishing the surface. Take care to round off the tip of the mast as well as that of the dowel behind the deck house. If the toy is intended for a very small child, the mast should be eliminated so that there would be no danger of his falling upon it.

Use the brightest reds and greens in painting, because the appeal of this freighter lies principally in its coloring. Stenciled windows and doors add to its appearance, but are not absolutely necessary. The cargo hold is painted gray.—DICK HIXON.



The principal parts of the hull and superstructure are band-sawed or scroll-sawed from $\frac{3}{4}$ " thick white pine, and the largest piece is jig-sawed in the center to form the cargo hold. The bottom is waterproof plywood



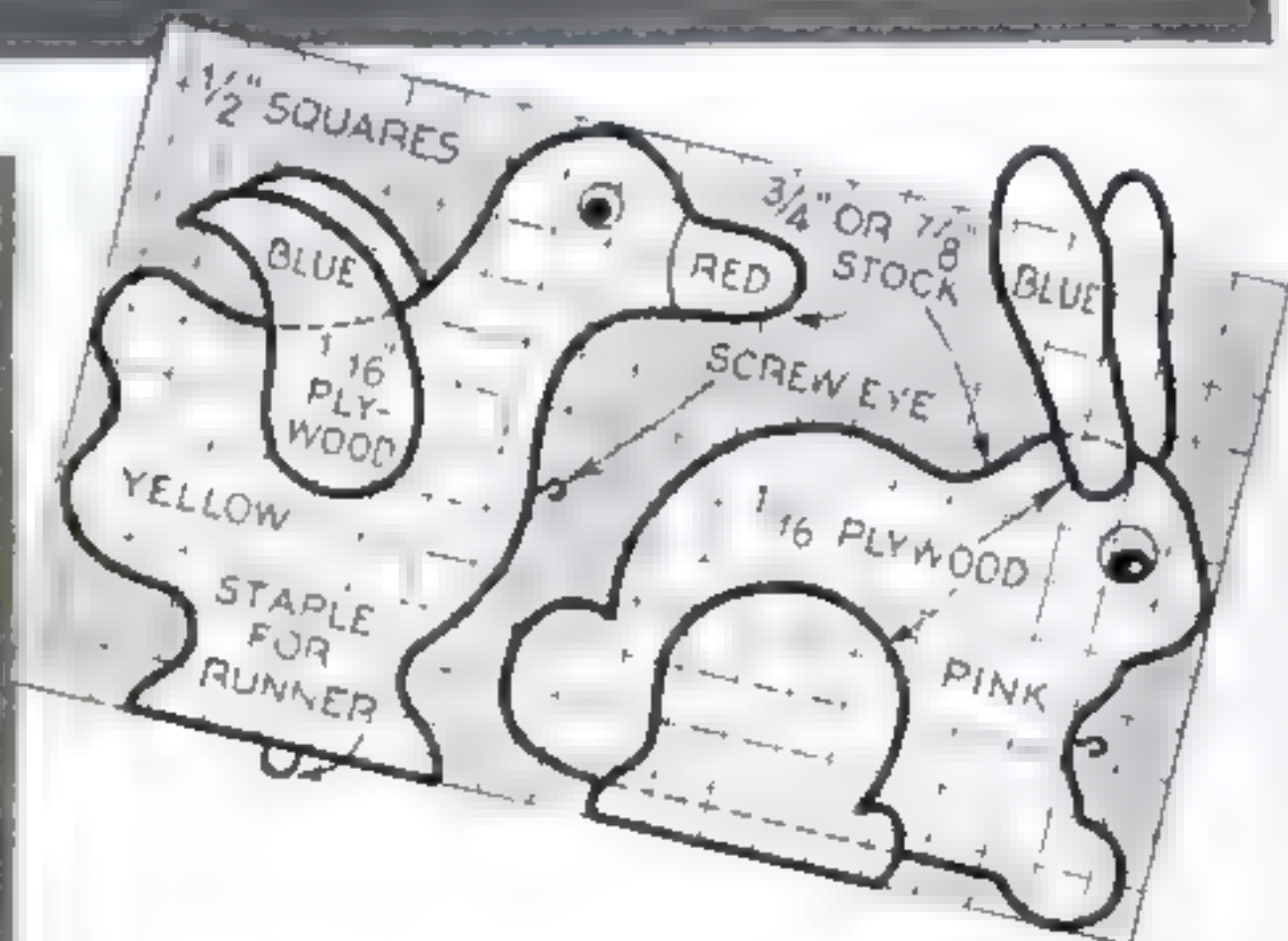
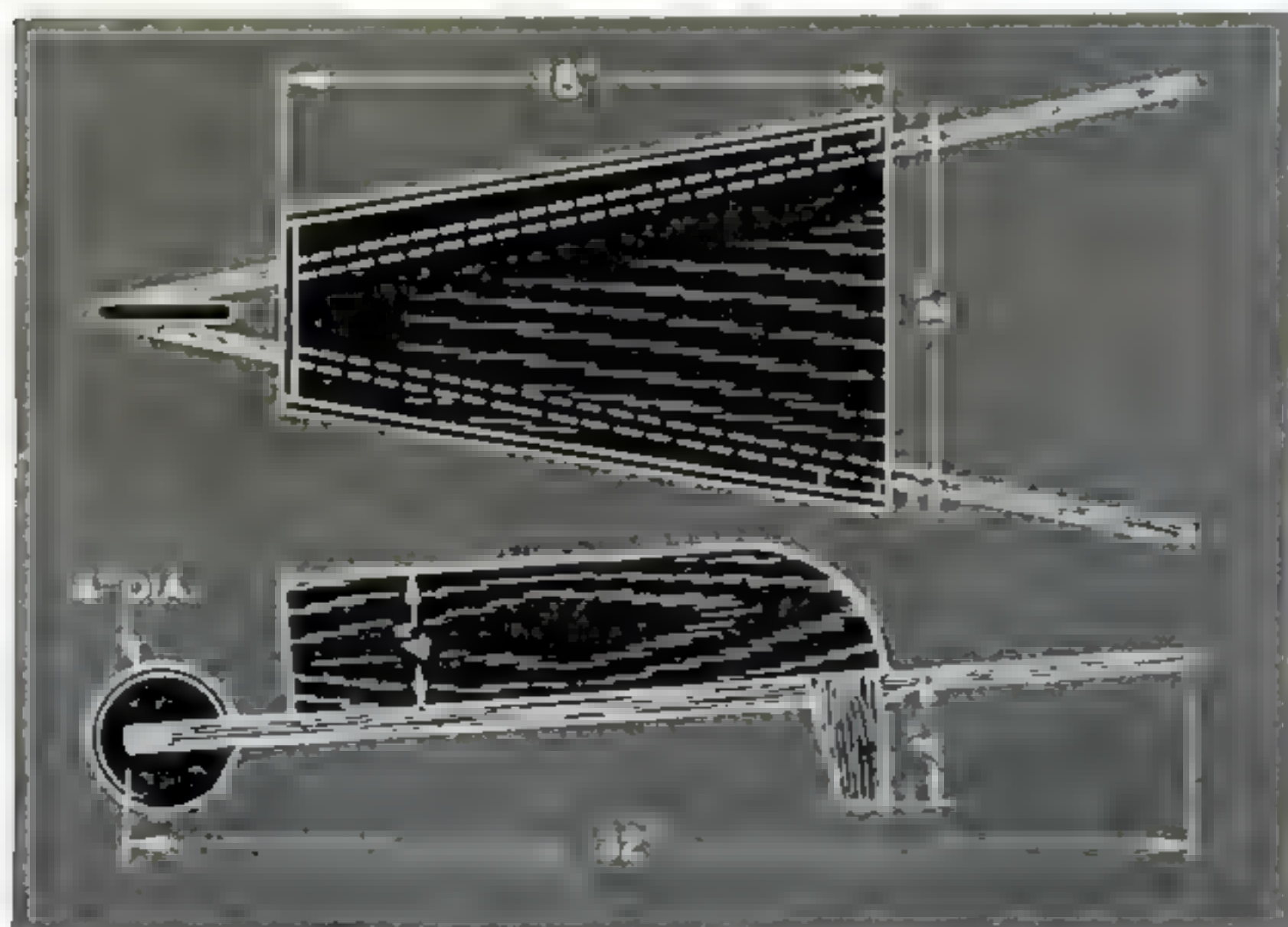
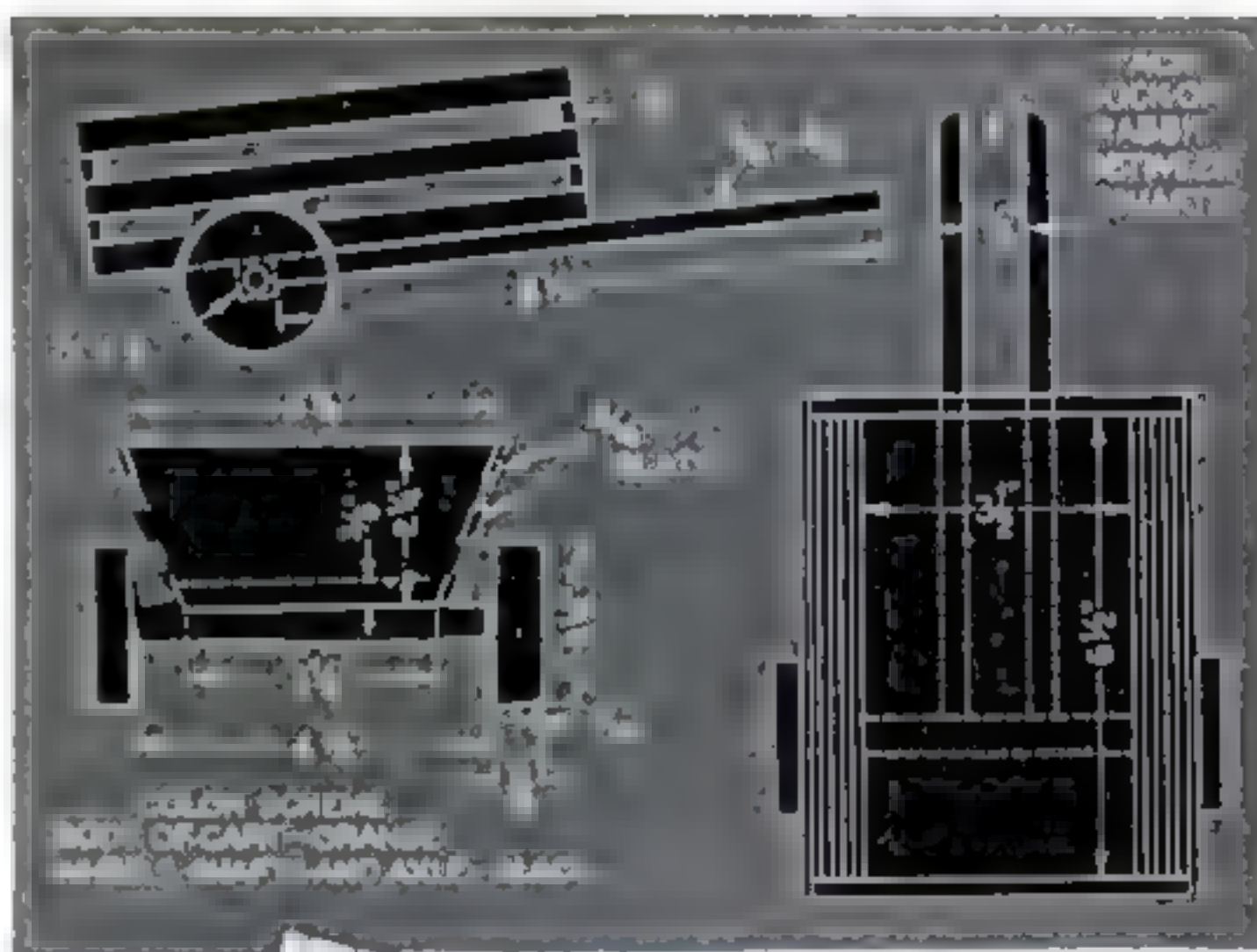
A simple toy truck. The wheels are cut with a hole saw and crowned on a sander, as at right



Toys Designed by Prize-Winning Club

FROM the work sheets of the Bison Homeworkshop Guild, Buffalo, N. Y., were taken the accompanying drawings of three toys designed especially for quantity production. It was the remarkable toy project of this club which won for it the national award for civic activities in the 1939 achievement contest of the National Homeworkshop Guild.

The drawings are self-explanatory. When a large number of toys are to be made, it is necessary to turn the parts out systematically and to use nailing jigs to speed up the assembly. In the case of the toy truck, for example, the stock for the hoods can be cut in long pieces, with the sides beveled to 10



These designs are from the work sheets of the Bison Homeworkshop Guild, Buffalo, N. Y., which won the 1939 Guild award for its toy project. The cart above is made either with a duck or a rabbit between the shafts

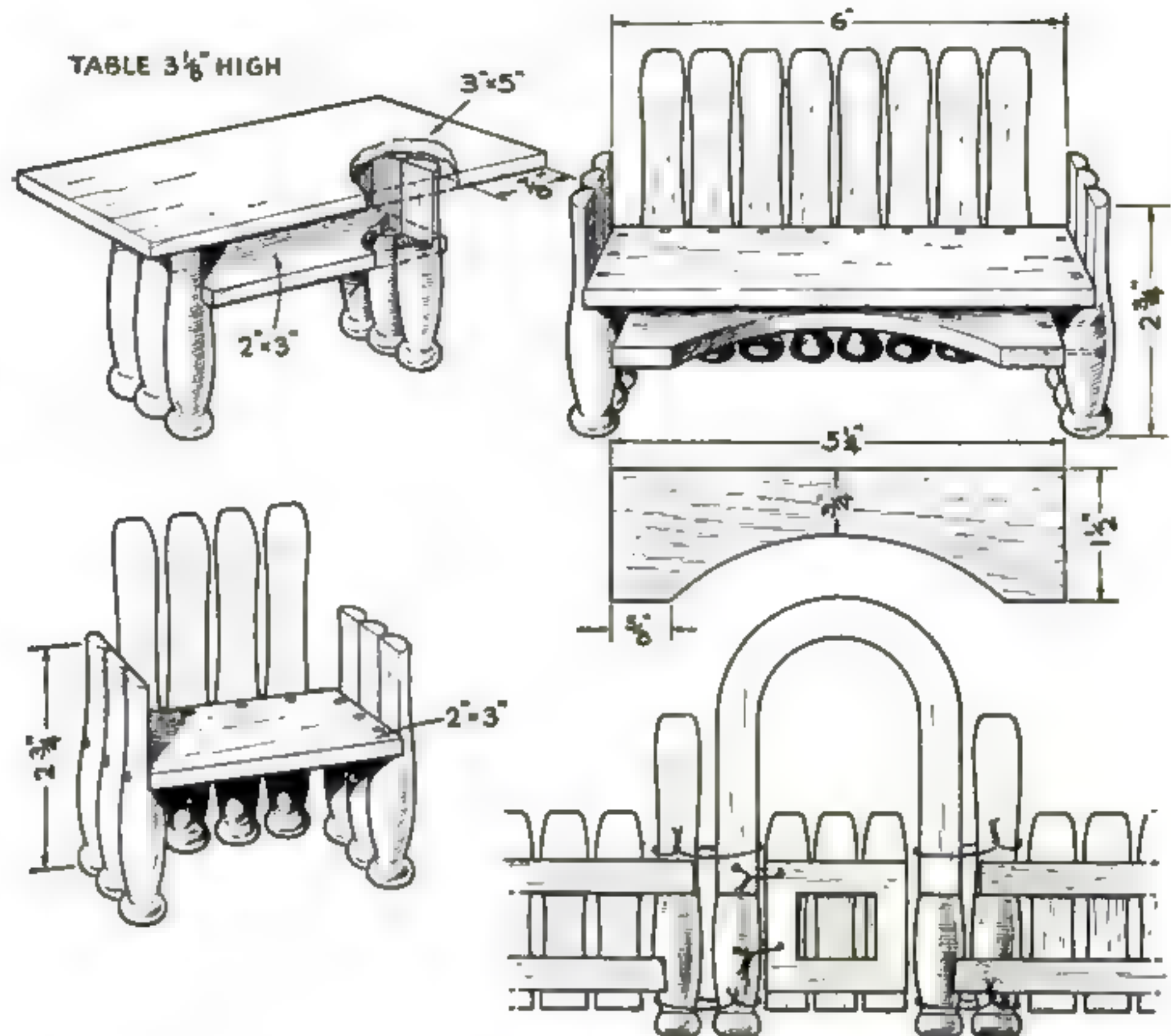
deg. The individual hoods are then cut to length and beveled on the front. Finally the shaded portions of the hood are sanded off.

The wheels are cut from $\frac{3}{8}$ " stock with a $1\frac{3}{4}$ " hole saw and later crowned on a sanding disk. This is accomplished by putting the blank wheel on a pin made by driving a nail in a piece of scrap lumber about 1" back of

the end and cutting off the head of the nail. The wheel is held against the sanding disk and allowed to spin on the pin. By swinging the handle end of the stick back and forth in an arc, a smooth, even crown to represent the tire can be put on the wheel in a few seconds. It is best to wear a glove on one hand and let two fingers ride on the wheel.

Toy Garden Furniture

BUILT FROM CLOTHESPINS



No matter how limited one's shop equipment may be, it is possible to make attractive and sturdy toy garden furniture from wooden clothespins and scraps of plywood

The long bench is made in the same way with a 2" by 6" piece for the seat. A brace cut as shown is placed below the seat. For the table, use a top 3" by 5", a shelf 2" by 3", and six pins cut $2\frac{7}{8}$ " long. The top is glued to the ends of the pins.

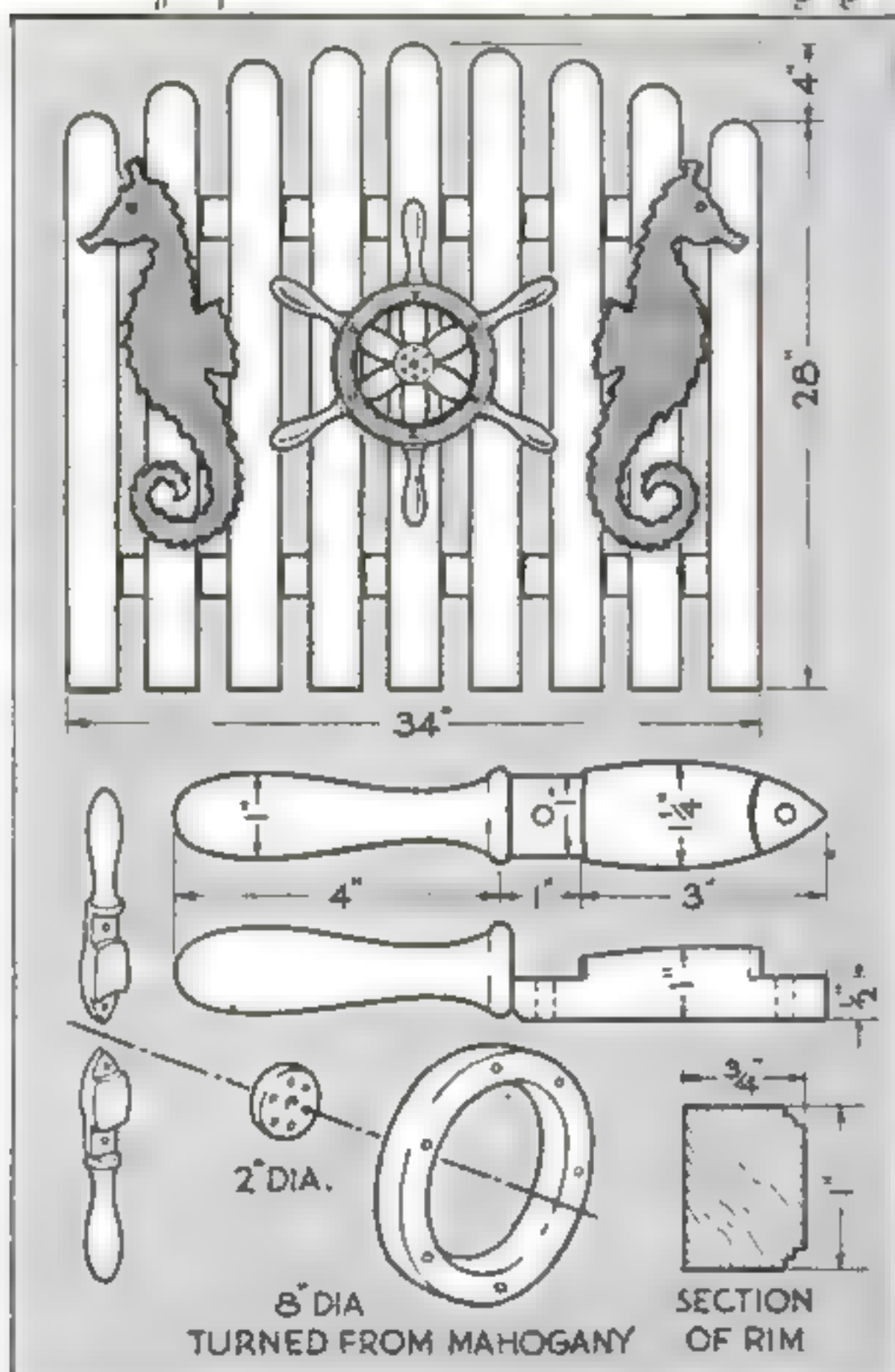
The fence consists of two $\frac{1}{2}$ " wide strips of thin plywood cut to the desired length. The ends of the upper strip are nailed to clothespin posts and rest on their cut edges. The ends of the lower strip are nailed into mortises cut into clothespins near their heads, as illustrated.

The gateway requires two clothespins nailed to a plywood arch so as to leave a 2" wide opening. The gate itself is cut from plywood $1\frac{3}{4}$ " long by $1\frac{5}{8}$ " high and has three pickets nailed to it. The hinges are made of wire, and the gateway and adjacent sections of fence are linked together with wire.—HAZEL F. SHOWALTER.

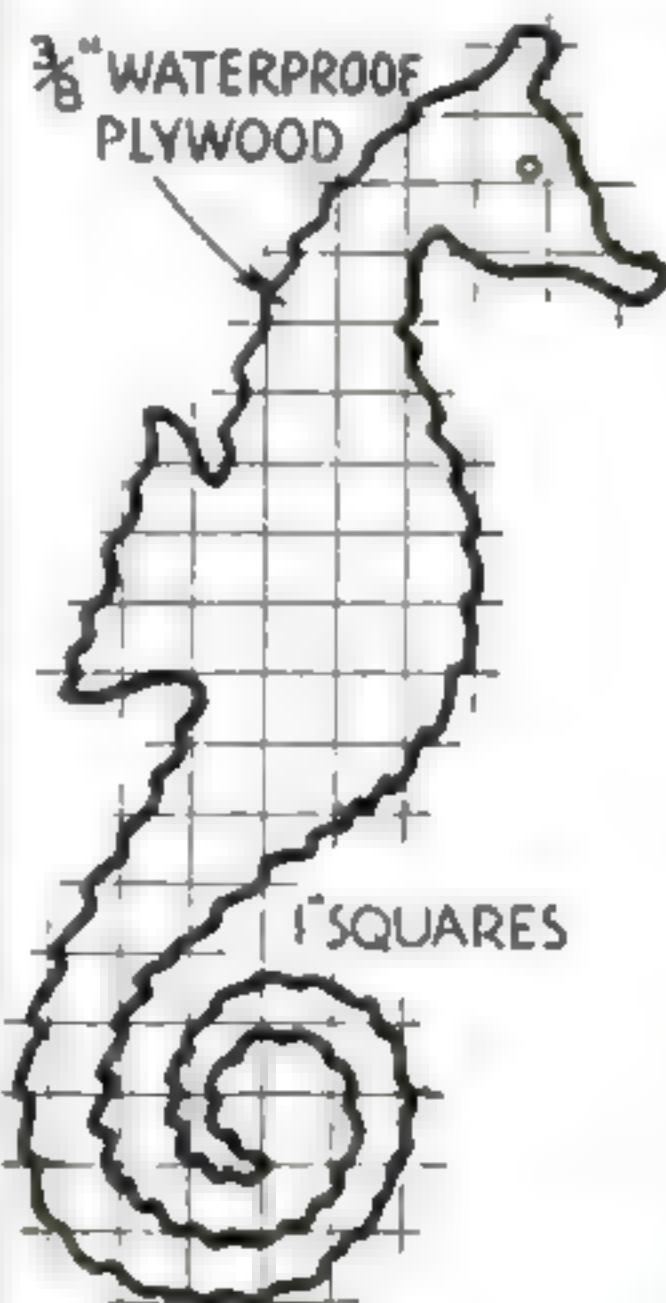
ONLY the simplest type of sawing, drilling, and nailing is needed to make toy garden furniture, fences, and gates from clothespins and scraps of $\frac{1}{4}$ " plywood. Each clothespin must have one of its legs cut off as indicated in the drawings, but the waste pieces are utilized for fence and gate pickets.

To construct a chair, cut a 2" by 3" piece of plywood and nail four of the clothespins to one long side, with two nails each, one through the seat down into the clothespin and the other through the clothespin into the edge of the seat. Shorten six clothespins to $2\frac{3}{4}$ " and nail three in place for each arm.

Marine Ornaments for Cottage Gate



A MAHOGANY pilot wheel flanked by two cut-out sea horses makes an effective decoration for the gate of a cottage, particularly one built on a beach or owned by a family interested in yachting or motor boating. In this case the pilot wheel is built up, the hub, six spokes and the ring being turned separately from mahogany. It is assembled with waterproof casein glue and brass screws, although dowels could be used if preferred. A similar pilot wheel also makes a pleasing ornament over the fireplace or in a boy's room.

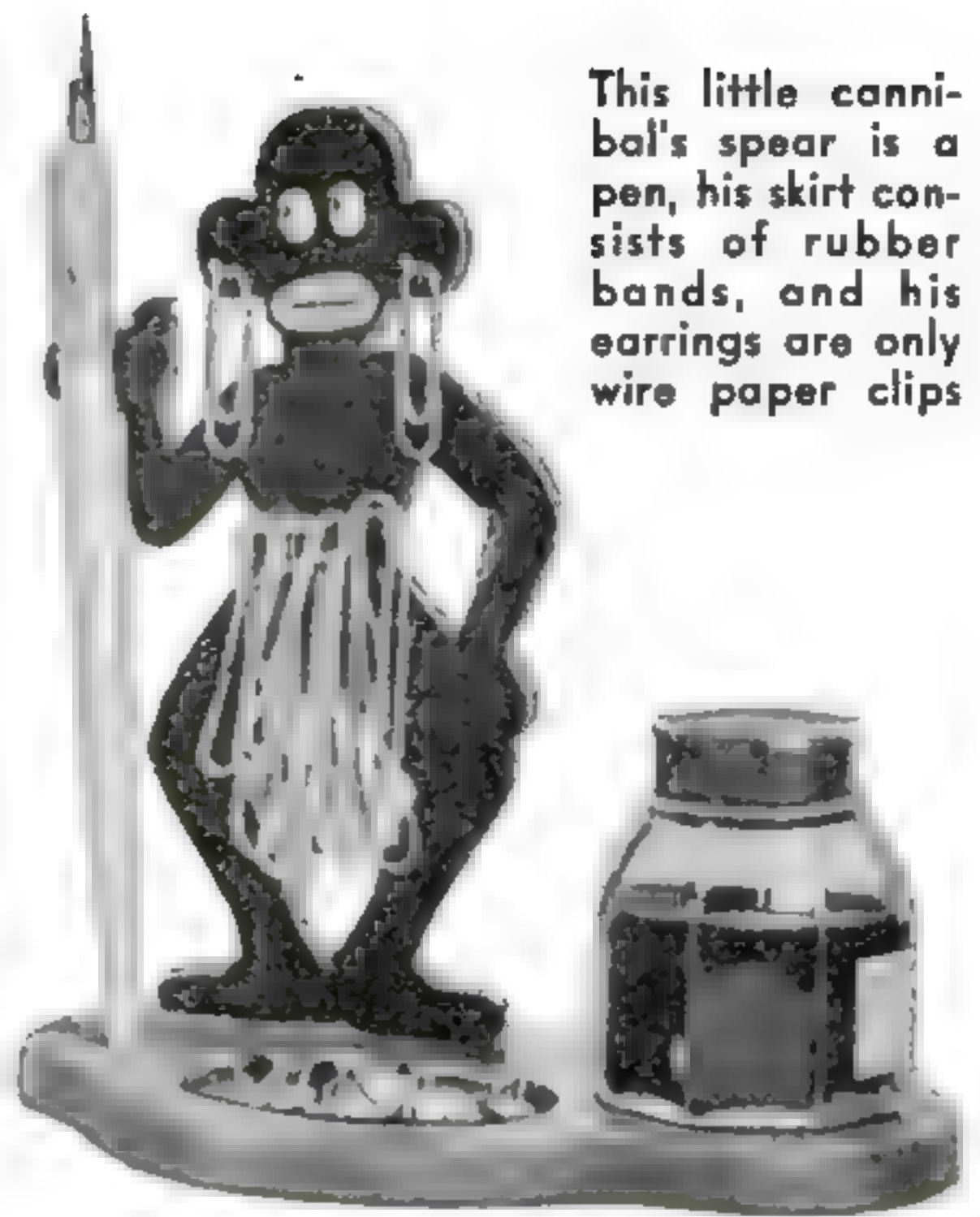
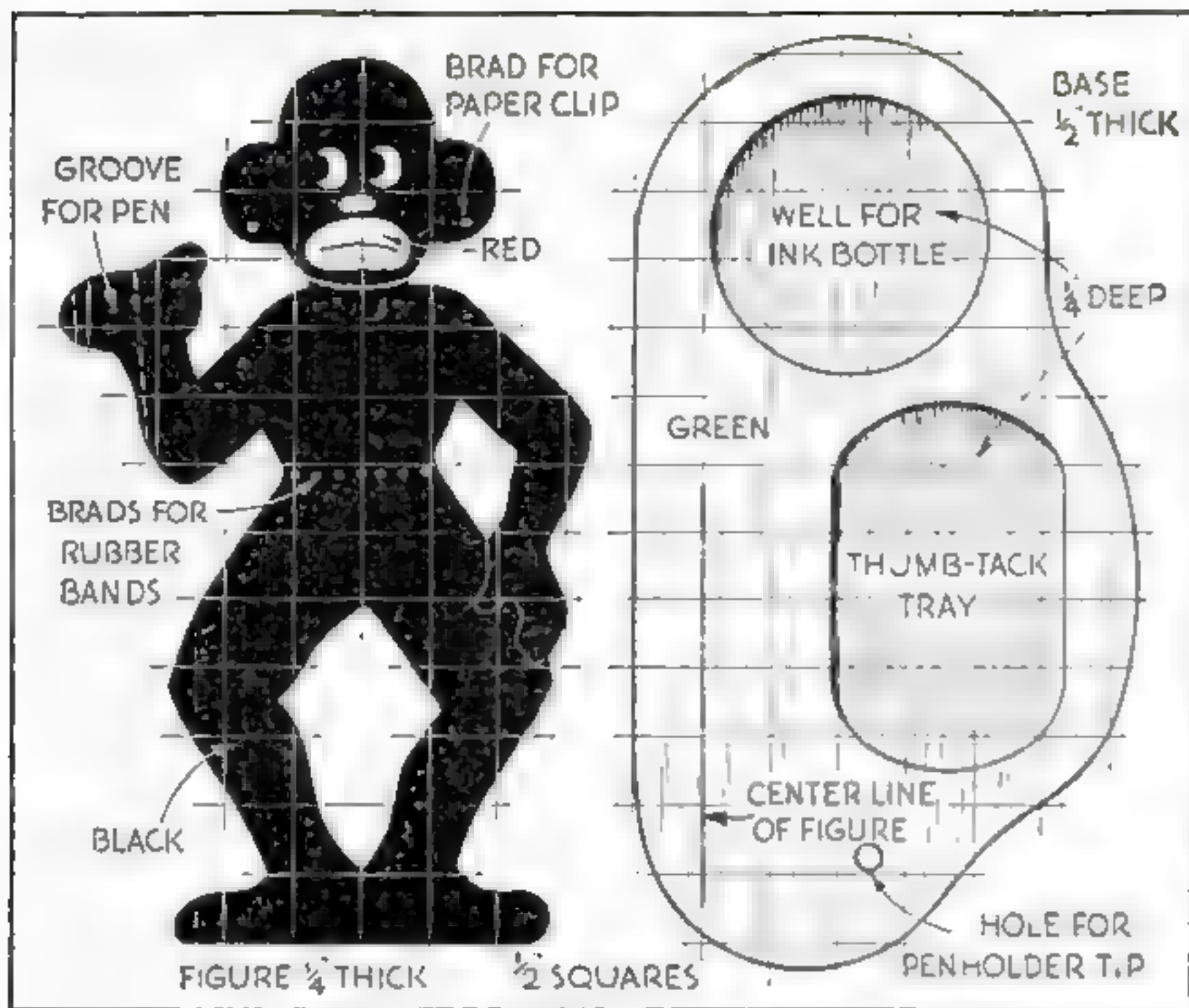


The sea horses are scroll-sawed from plywood of the waterproof variety. They are painted a natural mottled brown, but could be colored Chinese red if a brighter note is desired.—HI SIBLEY.

Flaming Alcohol Loosens Screws

HEAT can be applied to a corroded or rusty screw in order to loosen it by setting an empty .22 caliber rifle cartridge jacket (of the long or long-rifle type) on the head of the screw, partially filling it with denatured alcohol, and igniting the liquid. When the flame burns out, remove the jacket with pliers, because it becomes very hot. In most cases, sufficient heat will have been transmitted to the screw to loosen it. With this method there is no danger of injuring surrounding surfaces, as in the case of the electric motor illustrated.—W. C. W.





This little cannibal's spear is a pen, his skirt consists of rubber bands, and his earrings are only wire paper clips

Cannibal Figure Forms an Amusing Desk Novelty

RUBBER bands and paper clips never had a more novel holder than this cannibal figure, who stands guard so patiently over an ink bottle, spear in hand. His spear is, in reality, a penholder, and there is a little tray in front of him for holding thumb tacks or pins.

Enlarge the pattern for the figure, transfer to $\frac{1}{4}$ " thick wood, and jig-saw to shape. Cut the base from material $\frac{1}{2}$ " thick. Rout or

carve the receptacles for thumb tacks and ink bottle, sand the pieces, and assemble with glue and brads. Paint as indicated, or use a color scheme of your own choosing. Glue felt under the base to protect the polished surface of desk or table.

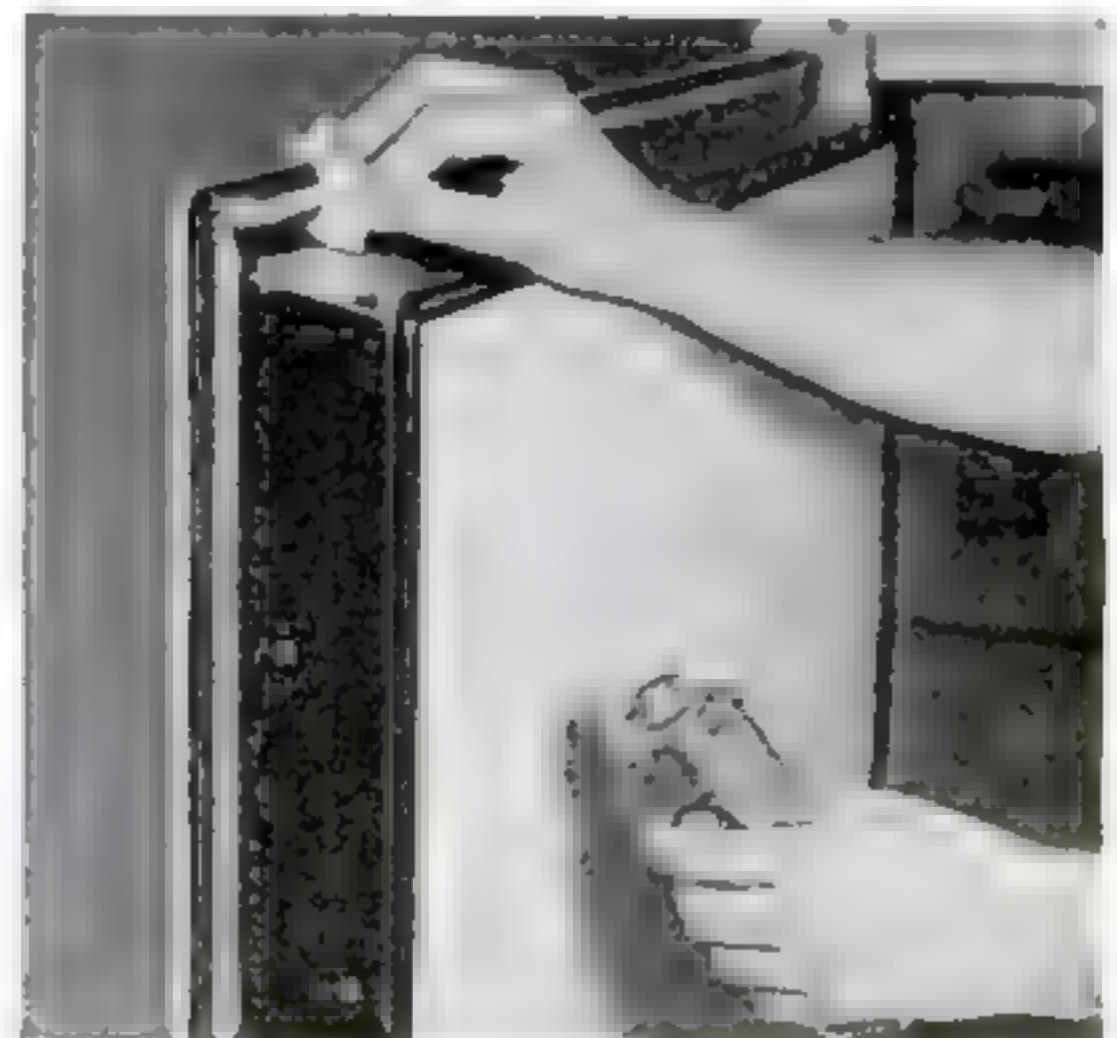
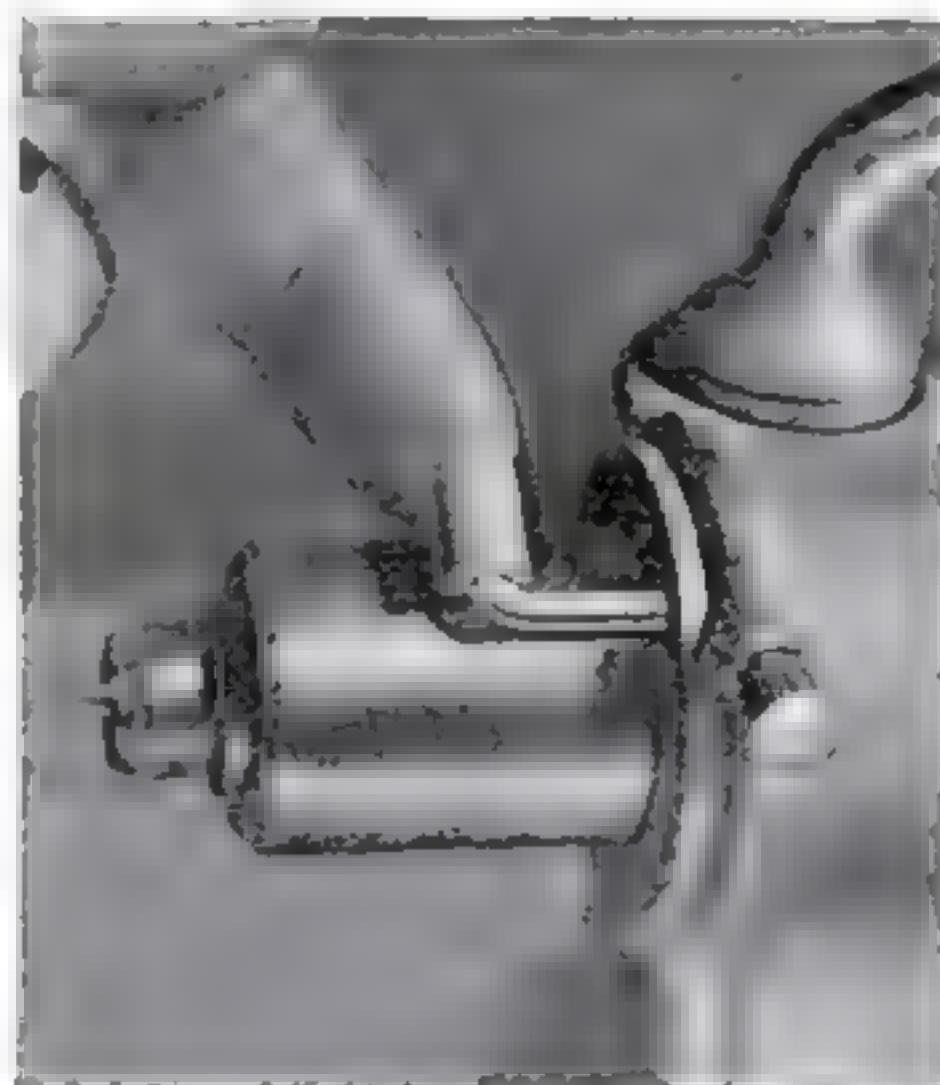
The paper-clip earrings and rubber-band skirt may be hung on brads or on small hooks bent from wire.—CARL L. SORESENSEN.

Shellacking Small Model Parts

SHELLAC may be applied to small model parts by using a pipe cleaner in place of a brush. The next time the cleaner is required for a similar job, the hardened end is merely cut off with pliers. This is more convenient than using a small brush, which has to be carefully cleaned in alcohol after use.—ERNEST W. RHUDA.

Guard for Tailstock Indicator

HANDS and clothing may be protected from the sharp point of the indicator used on a lathe tailstock sleeve by the simple method illustrated at the right. A short piece of wooden dowel is drilled for part of its length so that it will be a tight fit when slipped over the indicator point. It is easily slipped into place and can be removed in an instant.



Talcum Lengthens Life of Rubber Gaskets

OLD rubber gaskets around refrigerator doors can be made to last longer even after they have become sticky by coating them with talcum powder two or three times a year. Remove any rubber adhering to the cabinet where the gasket strikes with dry cleaning fluid.—W. E. B.

MINIATURE MODEL OF THE S.S. "PANAMA"



DAILY papers make frequent references to the swift pace with which our merchant marine is to be rebuilt. First to be completed in this huge ship-building program was the 10,000-ton liner *Panama*. In fact, she is the first new passenger ship constructed in this country in six years. With her two sister ships, *Ancon* and *Cristobal*, she will operate between New York and the Canal Zone in the service of the oldest ocean line under the American flag, the Panama Railroad Steamship Co.

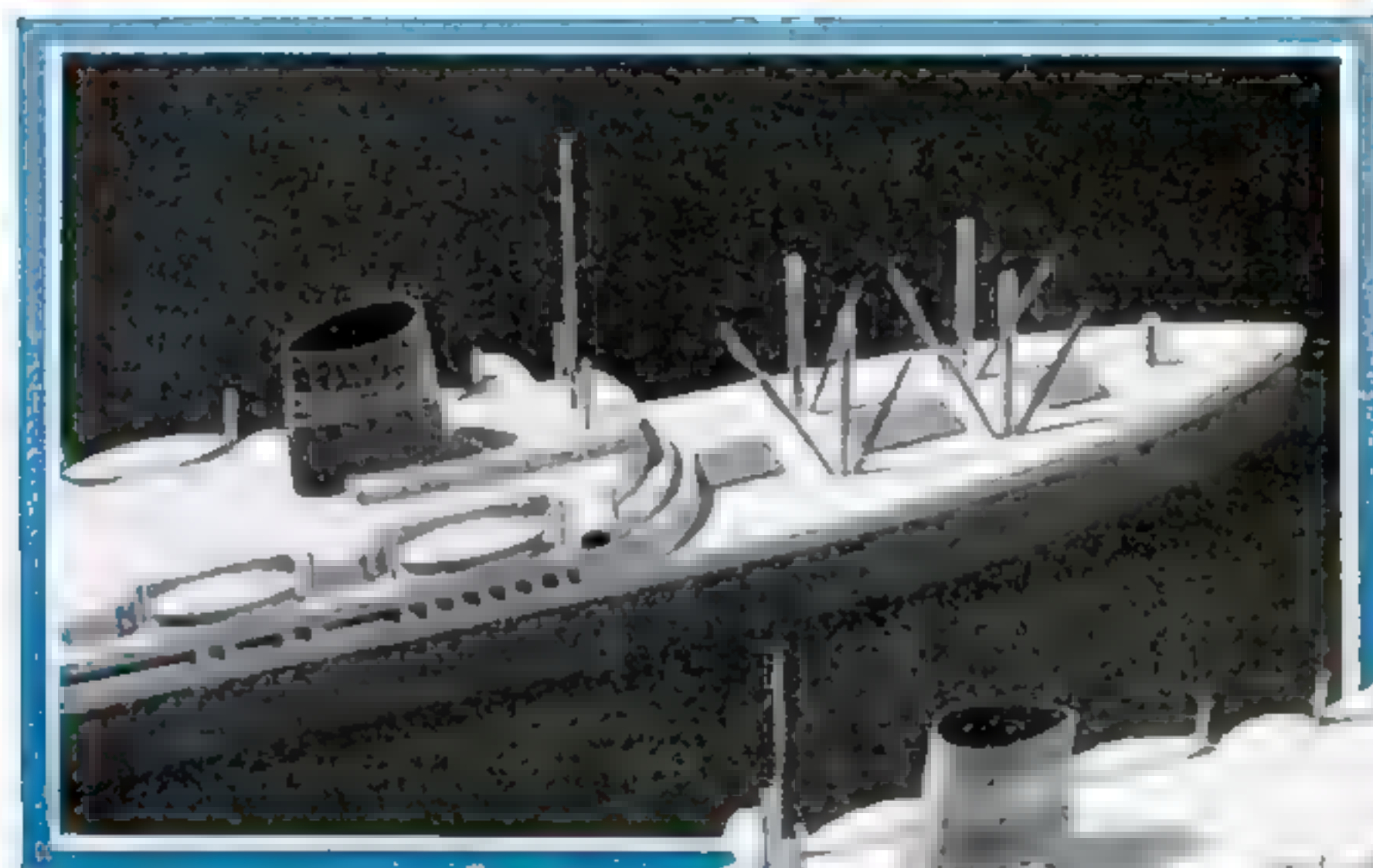
More than fifty other vessels of modern design are under construction, and hundreds more are planned. This vast building program, which is under the direction of the newly established Maritime Commission, is intended to bring about complete replacement of the aging vessels on which our foreign commerce now depends.



New American-Built Liner

Designed Especially
for the POPULAR SCIENCE
MODEL-of-the-MONTH CLUB

By THEODORE
GOMMI



The streamlined appearance of the *Panama* bespeaks the modern design and equipment that have gone into her construction. An attractive miniature water-line model of the ship can be easily made as shown on a scale of 1" equals 100'. This gives a model 5" long or exactly the size of the accompanying drawings. Because of its small size and comparative simplicity, the project is an excellent one for beginners.

The hull is shaped from a block prepared by gluing together piece *A*, the wedge *B*, and *C*. These are sandpapered to give a slightly flaring bow and a cruiser stern. The superstructure is formed by gluing together the pieces marked *D* to *K* after they have been cut to the shapes indicated in the drawings. It is merely a matter of cutting out the flat pieces and placing one on top of the other.

The derrick posts are common pins cut down to correct length, while the booms are thin wire. Paper is used for the hatches, funnel, and window strips. The funnel may be made from solid wood carved to shape, but a hollow funnel looks much better and can be made by winding and pasting a paper strip around a correctly shaped wooden form. The window strips, which are narrow pieces of paper cut as shown to form the window divisions, may be omitted although they greatly enhance the appearance of the model. The

LIST OF MATERIALS

WHITE PINE, BASSWOOD, OR Balsa

No.	Pc.	T.	W.	L.	For
1	3/16	5/8	5		<i>A</i>
3	1/32	5/8	5		<i>B, C, D, E, F, G, K,</i> <i>J, and lifeboats</i>
1	1/16	1/2	5		<i>H and I</i>

MISCELLANEOUS

12 pins (1 1/2" long, but remove heads and cut to length) for derrick posts, etc.

36" thin stiff wire for davits, derrick booms, and mast.

Sheet of good quality writing paper for funnel, hatches, and window strip.

Small piece of thin tin foil for funnel markings.

Buff, gray, and white paint.

Note: All dimensions are given in inches.

lifeboats are carved to the conventional shape and glued to *E* between wire uprights representing davits.

The hull is gray as far as *C*. From *C* up, the hull and superstructure are white. Hatches and derrick booms are buff. In the prototype, the funnel is buff with three shiny, stainless-steel stripes. These can be represented in the model by gluing on narrow strips of tin foil.

Handle on Wire Brush Lessens Fatigue

A WIRE brush can be used with considerably less fatigue for removing old paint or other cleaning purposes if a handle about three feet long is nailed or screwed to it as illustrated below. Round the edges of the handle and sandpaper it smooth.—R. G. PETER.



If a long handle is fastened to it, a wire brush is not so tiring to use on heavy work



Container for Bicycle Patches

LETTER CARRIERS, newsboys, and others who use bicycles day after day to cover comparatively long distances often make it a practice to carry with them some patches and cement for emergency repairs to bicycle tubes. A good container for the patching outfit can be made from a discarded flash-light case by closing up the lamp-socket hole. It is held on the frame as shown by bending two pieces of 1" by 1/16" strap iron or brass about 5" long to form a figure 8 and bolting it in the middle with a 1" by 3/16" bolt and wing nut.—FRANK HEGEMEYER.

PICKING STICK FOR VARNISH

[PAINTING]

In applying varnish, it is frequently necessary to remove specks of lint or other foreign material that have settled on the wet film. This is best done by means of a picking stick made as follows: Heat nine parts of brown rosin and one part of varnish in a small, clean vegetable can while constantly stirring the mixture. Continue the cooking until a drop deposited on a scrap of glass will form a stiff pill. Fasten the drop on the end of a 1/16" diameter applicator rod (obtainable at any drug store) or a small, stiff wire. Mold the drop to a convenient shape with moistened fingers. Touch this end of the stick or wire to any speck of lint or foreign material in the wet varnish and lift it up. Don't push it out. To make the working end sticky again, simply tap the small ball lightly against the palm of the hand.

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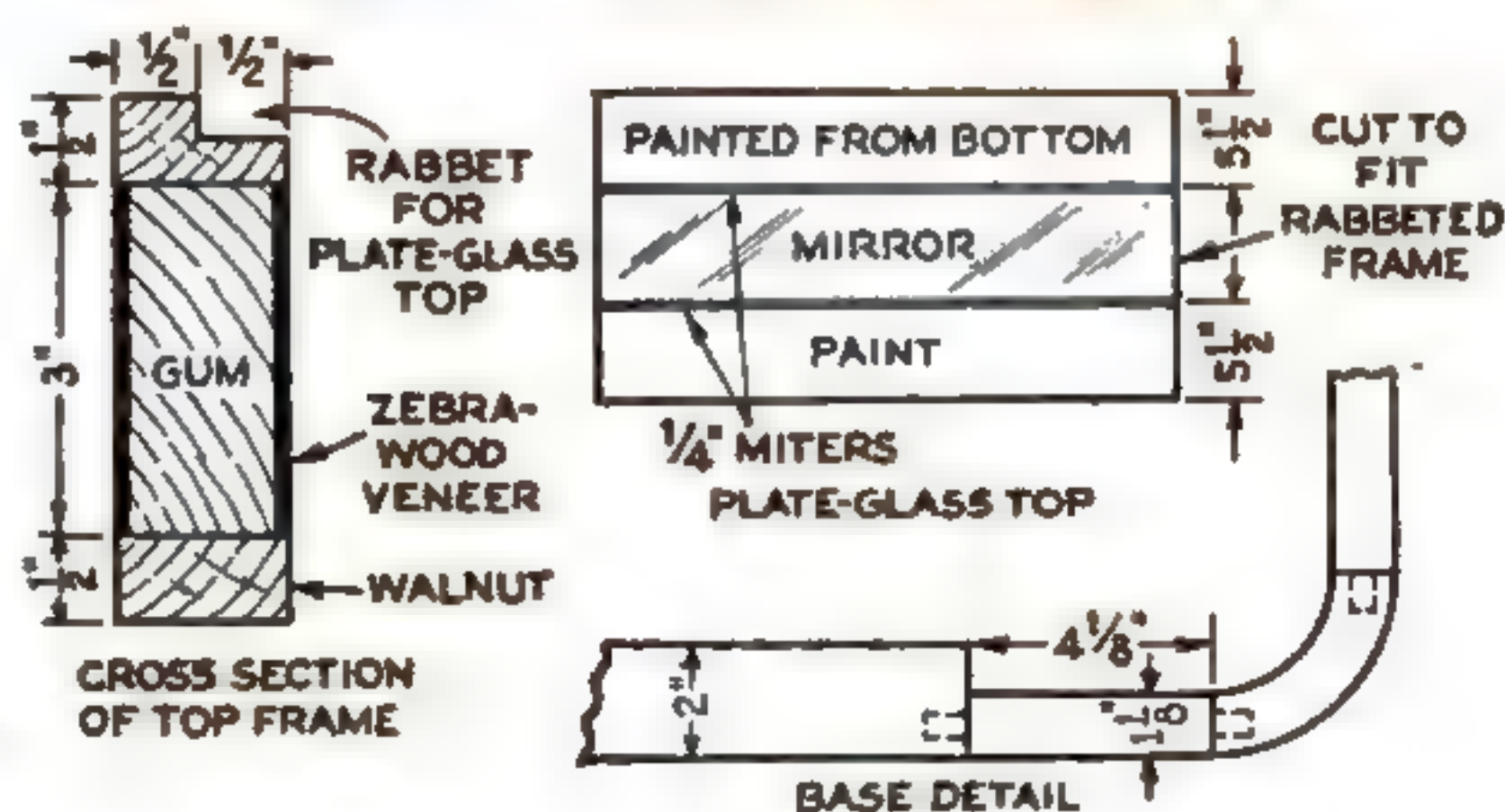
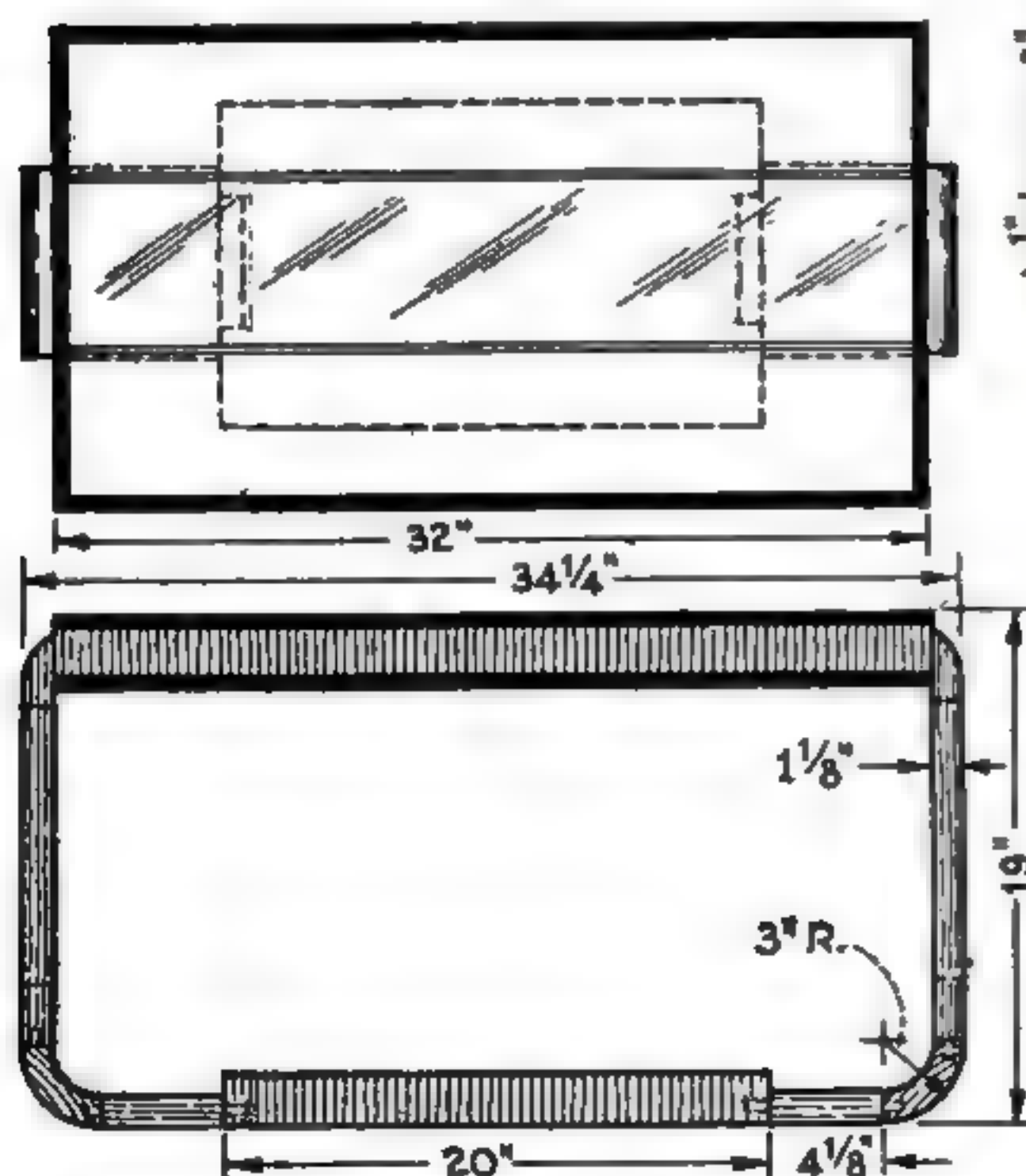
Glass-Topped Cocktail Table

SIMPLICITY of line, beauty of wood, and durability are combined in this modern cocktail table. The original is walnut and zebra-wood veneer with a plate-glass top. Gumwood or blond-finished maple could be used, if preferred, instead of walnut.

The core of the base is built up of white oak; the edges are veneered with striped walnut and trimmed when dry; then the top surface is veneered with four-piece matched butt walnut. If no veneer press is available, several automobile jacks may be used in conjunction with 2" by 4" pieces braced against the floor joists above the shop.

For the end pieces, 1½" by 7" black walnut boards are used with 3" by 3" walnut squares at the lower ends to enable the rounded corners to be shaped. The inside coves are cut on the bench saw. The outside corners may be left square until all the joinery is completed, when they can be rounded off with a plane and finished with a wood file and sandpaper.

Mortise-and-tenon joints are used throughout. The ¾" by ⅜" tenons are cut on the bench saw



This modern piece is distinguished by simple lines and beautiful grain. The glass top is silvered in the center



At left, the assembly drawings. Above, details of the base and the top frame as well as a layout for the glass

By
**RALPH R.
KOFER**

and the mortises on the drill press. All are cut 1" short to insure good blind points.

The uprights are next routed with a half-round router bit, or by hand with a half-round gouge. The short filler pieces which go between the uprights and the base are now glued to the uprights. When these joints are thoroughly dry, the end units are glued to the base and the outside corners are rounded.

The upper frame is prepared by veneering a gumwood board with striped zebra on both sides. The board is then cut into two pieces 2" by 33" and two pieces 2" by 19". The edges are covered with 1/2" thick pieces of walnut, the upper strip being rabbeted as shown to receive the plate glass. These strips are glued and fastened with finishing nails. The corners of the frame are mitered and assembled with corner blocks or miter nails. The complete frame is then fastened between the uprights with wood screws.

The wood may now be finished by staining, filling, and varnishing or in any way desired. No pains should be spared to obtain as perfect a finish as possible.*

The plate-glass top can be obtained from any glass house. Order two 1/4" miters cut on the bottom 5 1/2" or 6" from each long edge so

*See "Better Methods of Finishing Furniture and Other Woodwork" in "Amateur Craftsman's Cyclopedia," Popular Science Publishing Co., Inc., New York; \$1.95.

LIST OF MATERIALS

Base—1 pc. white oak, 2" by 6" by 48"; 3 sq. ft. striped walnut veneer for edges; four-piece matched butt walnut veneer, 12" by 24".

End pieces—1 pc. black walnut, 1 1/4" by 8" by 48" and 1 pc. 3" by 3" by 18".

Top frame—1 pc. gumwood 7/8" by 10" by 36"; 1 pc. zebra wood veneer, 12" by 36"; 1 pc. second-grade veneer for reverse side, 12" by 36".

Plate-glass top cut, silvered, and painted as specified; nails, screws, glue, finishing materials, etc.

as to divide the glass into three sections. Have the center section silvered and the two side portions painted light cream paint. If necessary, you can apply the paint yourself, provided you stipple it on with a small wad of cheesecloth so as to avoid all brush marks and streaks. When the paint has dried, apply several coats of varnish to the bottom. Then set the glass into the frame, and the table is complete.

The original table cost \$6.23 for wood and veneer and \$5.00 for the glass top, cut, silvered, and painted. The construction required about fifty hours.



This tiny wall safe is a standard steel receptacle box with a regular cover plate, to which is fastened the front of a duplex outlet. For realism, a lamp can be plugged in

Bills and Jewels Hidden in Dummy Outlet

A COMPARATIVELY safe place to conceal bills or jewelry can be provided by installing a dummy electric outlet in the wall or baseboard. Choose a position where such an outlet would normally be found. Cut an opening and insert a standard steel receptacle box. A duplex outlet and a cover plate will also be required. To save space in the box, take the duplex outlet apart and discard as much as possible of it; then attach the front

section to the cover plate with the center set screw. First, however, drill one extra hole through the cover plate near the top so that it can be attached to the wall with a wood screw. This screw is not likely to be noticed, but for extra realism and to fool intruders, a lamp may be plugged into the outlet whenever the house is to be left for any length of time.—ELLSWORTH CASSING.



COPPER and ALUMINUM CANDLESTICKS

THESE modern candlesticks consist of an aluminum tube inclosed by a copper tube and a base built up of alternate copper and aluminum bands about $\frac{3}{16}$ " wide.

To assemble the base, a form is made by cutting a 3" hole in a $\frac{1}{8}$ " thick board. The strips are crowded together by forcing a wedge between the ends. In the center a 1" washer is placed temporarily. Then the disk is bound tightly with wire and one side is filed smooth. The copper rings are next tinned and soldered to a brass disk $3\frac{1}{4}$ " in diameter, after which the base is replaced in the form and the upper surface polished.

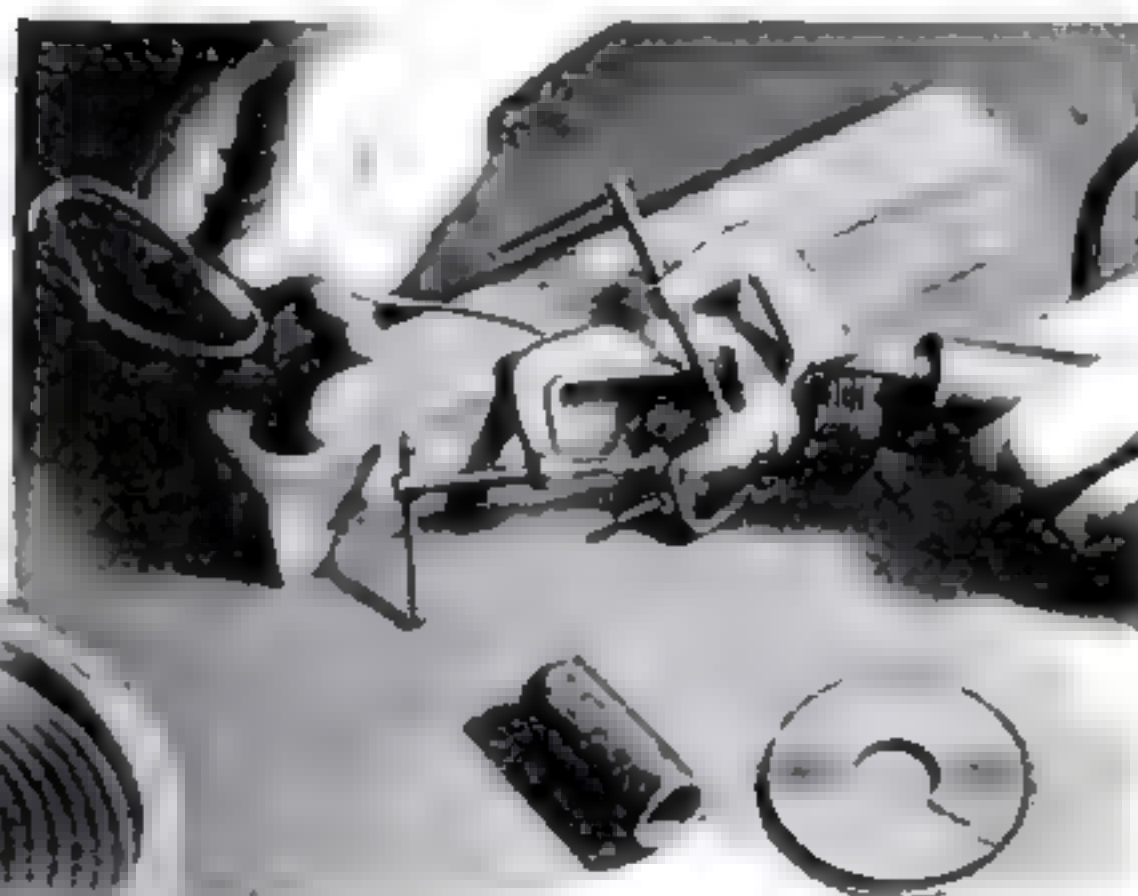
The stem is made by placing a $\frac{7}{8}$ " outside diameter, 22-gauge aluminum tube $2\frac{1}{4}$ " long in a similar copper tube 1" in outside diameter and filling the space between with a strip of sheet aluminum.

The handle is formed by bending a $\frac{1}{2}$ " length of 1" copper tubing to shape, wrapping a strip of aluminum around it, and then a strip of copper around that. Several holes are drilled in the aluminum strip to allow the two copper bands to be soldered together. A bolt is soldered in one side of the handle for fastening it to the stem, which must be filed to provide a neat joint.

Next, two strips each of copper and aluminum are placed around the base and soldered. The top of this rim is filed down to within $\frac{1}{8}$ " of the base and polished. A notch is filed in it to receive the handle, and the stem and handle are soldered to the base. The stem is filled to within 1" of the top with plaster. The holder is then polished.—MERLE TERRILL.



Flowing solder over the coiled strips so that the brass base may be attached. The strips were previously filed smooth



Copper parts of the handle are soldered together through holes drilled in the aluminum strip



Inserting the stem in the base. The outside copper strip on the handle is bent down and soldered to the bottom

Leather-Covered Paddle Straightens Tubing

COPPER tubing of small diameter can be straightened quickly by means of a paddle made of fiber and faced with leather approximately 1/16" thick. The tubing is laid on a metal plate or hardwood board as illustrated below and gradually rotated while being struck with the paddle. This method is handy for the garage mechanic when it is necessary to straighten an automobile fuel or hydraulic brake line that has been bent in the course of removal from the car.—PETER ROSSMANN.



The tubing is rotated and struck with the paddle



Reel to Hold Chalk Line

A FAST-WINDING reel for a chalk line or garden line may be made from a discarded metal spool of the type used for electric wires, which can often be had for the asking from a hardware or electrical dealer. Cut a wooden handle to project about 5" and trim or turn down to fit the hub of the spool. A metal washer is used at the end to hold the spool in place, and a small door knob is fastened on the right-hand flange for winding the reel.—F.H.

GRINDING—Wheel Speed

Type	
Cutlery wheels	
Cutting-off wheels (rubber, shellac, resinoid)	
Cylindrical grinding	
Hemming cylinders	
Internal grinding	
Knife grinding	
Snagging, off-hand grinding (vitrified wheels)	
Snagging (rubber and resinoid wheels)	
Surface grinding	
Tool and cutter grinding	
Wet tool grinding	

[METAL WORKING]

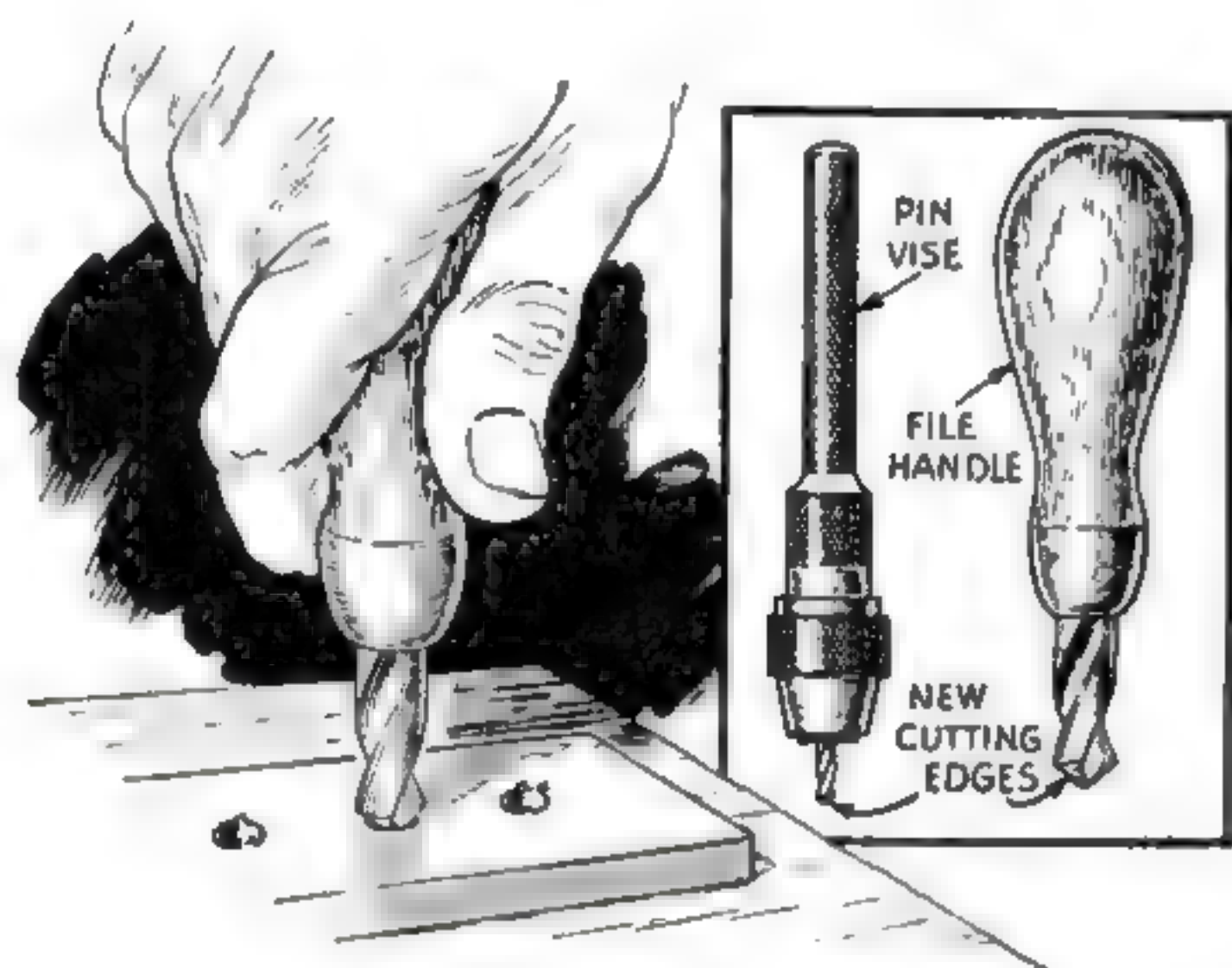
Surface Feet per Minute	
4,000 to 5,000	
9,000 to 16,000	
5,500 to 6,500	
2,100 to 5,000	
2,000 to 6,000	
3,500 to 4,500	
5,000 to 6,000	
7,000 to 9,500	
4,000 to 6,000	
4,500 to 6,000	
5,000 to 6,000	

To determine the number of revolutions per minute, divide the surface speed in feet per minute by the circumference of the wheel you are using. The circumference is equal to the diameter (feet or fraction of a foot) times 3.1416.

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Flat, Air-Tight Base Improves Coal-Fired Water Heater

SMALL coal-burning water heaters, especially when installed in an old basement, sometimes give trouble because they burn too fiercely and use too much fuel. This is likely to be due to air leakage under the base of the stove where it rests on a broken, cracked, or uneven concrete floor. A very small crack will cause a considerable draft even when the ash-pit door is closed and the stove is checked. The remedy is to dismantle the heater and pour a smooth, level concrete base. Set the heater base on the concrete while it is only partially hardened. Also refit the ash-pit door more snugly, if necessary.—S.W.J.











Broken Twist Drills Used for Reaming Out Burrs

TWIST drills that have broken off close to the shank and are therefore ordinarily thrown away can be put to good use for removing the burr from drilled holes as illustrated at the left. The smaller sizes are held in a regular pin vise and the larger ones in file handles or in handles turned from hardwood. Of course, it is necessary to grind new cutting edges. In use, always choose a drill considerably larger than the hole which is to be cleaned.

AREAS OR SURFACES

[CALCULATIONS]

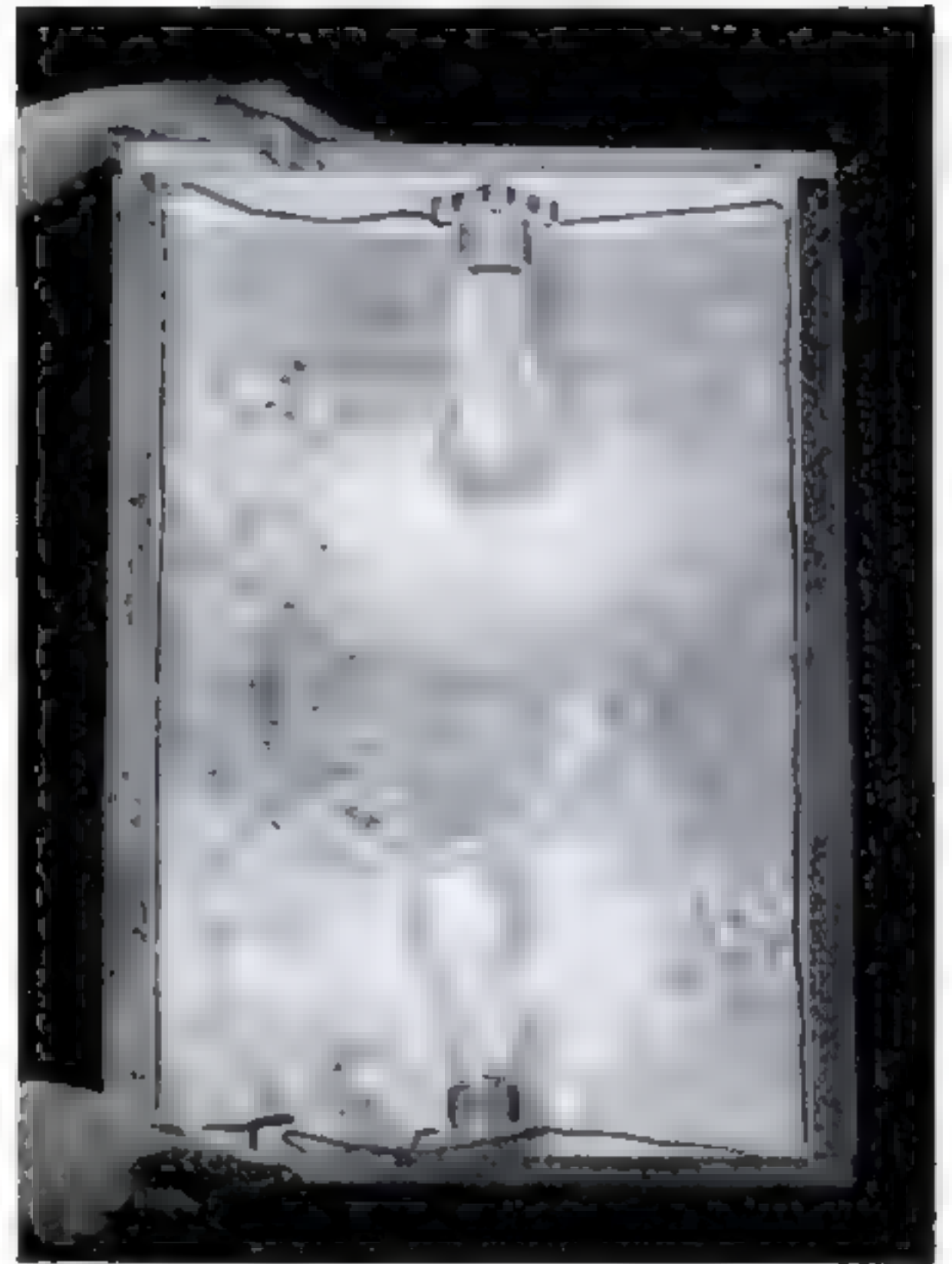
-  Triangle=base times half perpendicular height
-  Parallelogram=base times perpendicular height
-  Trapezoid=half sum of parallel sides times perpendicular height
-  Circle=radius squared times 3.1416
-  Ellipse=long diameter times short diameter times 0.7854
-  Regular polygon=sum of sides times half perpendicular distance from sides to center (altitude of triangle)
-  Cylinder=area of both ends plus circumference times height
-  Sphere=diameter squared times 3.1416

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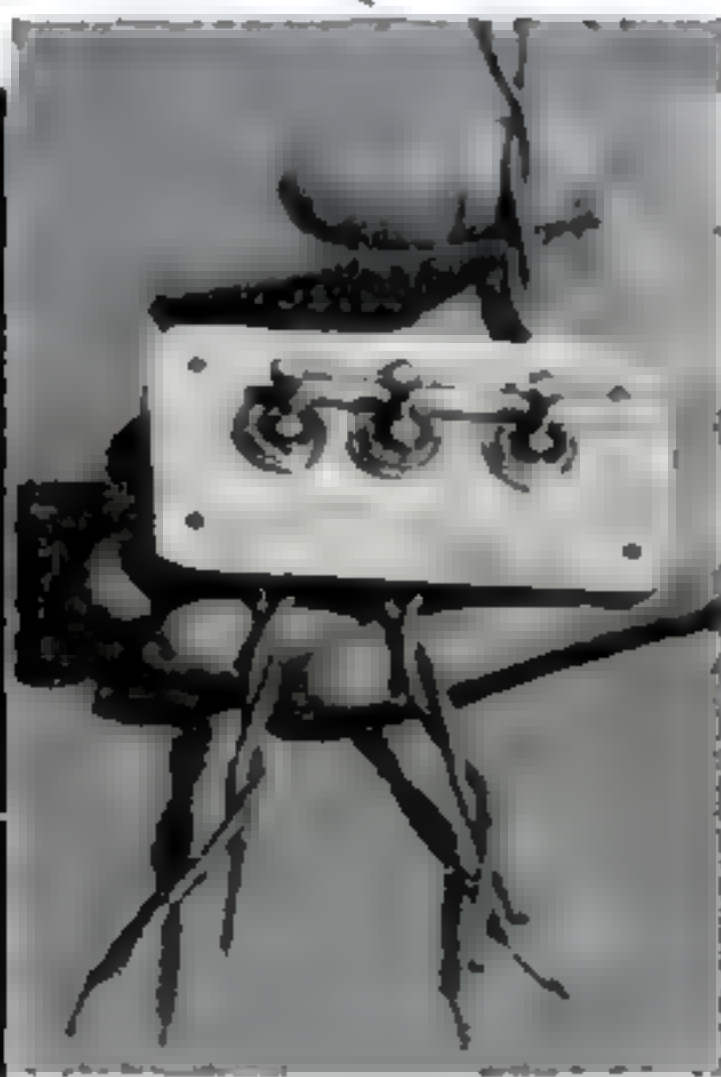
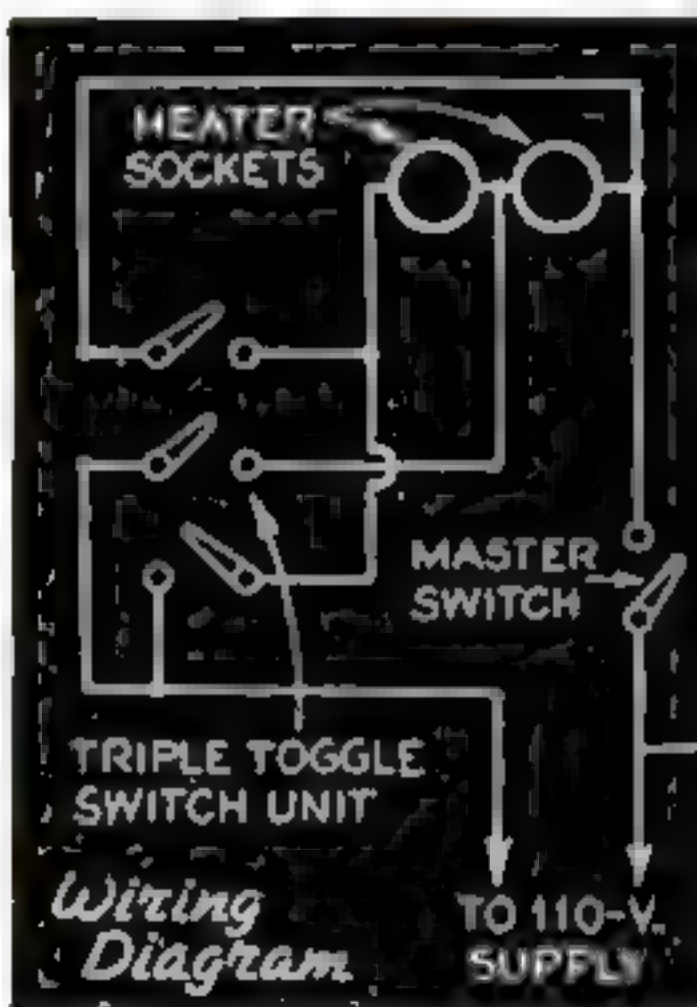
Homemade Print Drier



A sheet of canvas clamps the two chrome ferrotype plates to the curved surface of the drier. Each plate measures 10" by 14"



By replacing the heating elements with high-wattage bulbs, the drier becomes a reflector



Three ordinary toggle switches are attached to a piece of sheet metal. One is in reverse position

AN ELECTRICALLY heated print drier and a general utility lighting unit are combined in the device illustrated. As a print drier, it holds two 10" by 14" chromium ferrotype plates for drying the prints flat with a high, even gloss; and matte prints can be dried between blotters. As a lighting unit, it has a high-low switch to enable photo-flood lamps to be dimmed when arranging the lights, thus cutting down current consump-

tion and giving the bulbs a much longer life.

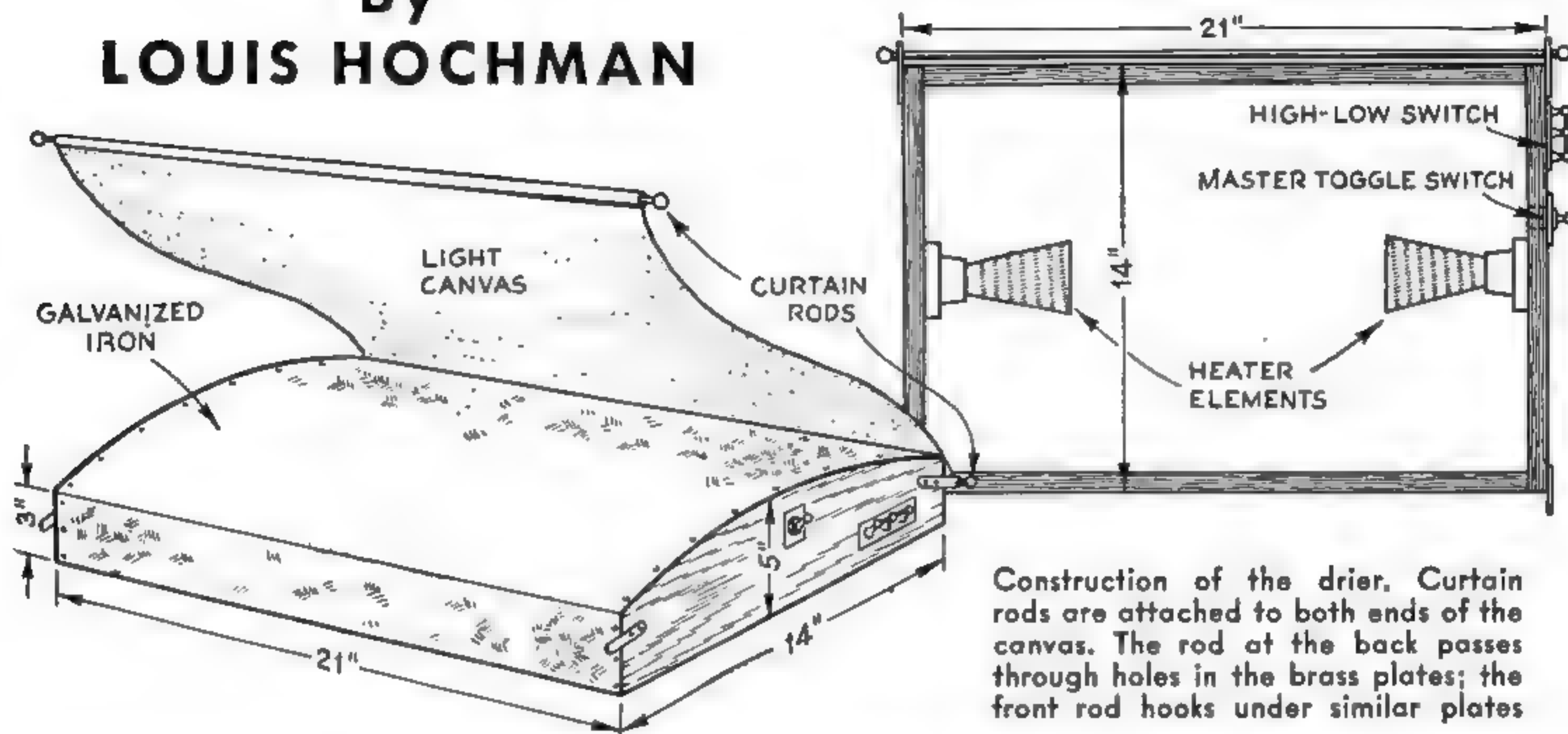
The two sides are cut from pieces of wood $\frac{3}{4}$ " by 5" by 14". Two strips $\frac{3}{4}$ " by 3" by 19 $\frac{1}{2}$ " hold these ends apart, and the whole frame is covered on top as shown with galvanized iron. A sheet of lightweight white canvas is attached to the back by means of a curtain rod, which is passed through holes in two brass plates screwed on the sides. This canvas stretches tightly over the curved metal surface and hooks on the front under two similar brass plates. It clamps the ferrotype plates down to the curved surface while prints are drying.

Inside, a porcelain socket is screwed to each end; and alongside one, a hole is cut to accommodate the switch unit. This consists of three ordinary 110-volt toggle switches attached side by side to a sheet of metal. One is placed in a reverse position to the others, so that when all switches are thrown in unison, one will be off and the other two on, or vice versa. To insure the switches working in unison, drill holes through the knobs, pass a rod through them, and solder it in place. Another toggle switch can be installed to control the entire unit.

Heat is provided by two heating elements, which are screwed into the sockets and

Doubles as Lighting Unit

By
LOUIS HOCHMAN



switched on low heat. Two 100-watt bulbs on high will also serve the purpose.

In use, the unit should be kept on a metal-covered table. The prints are squeegeed onto the ferrotype plates in the usual manner, then placed face up on the drier. The canvas is

clamped down over them, and in from five to ten minutes the prints will be dry. Use only chromium ferrotype plates with this drier.

If no metal-covered table is available, place a piece of galvanized iron about 15" by 22" under the drier.

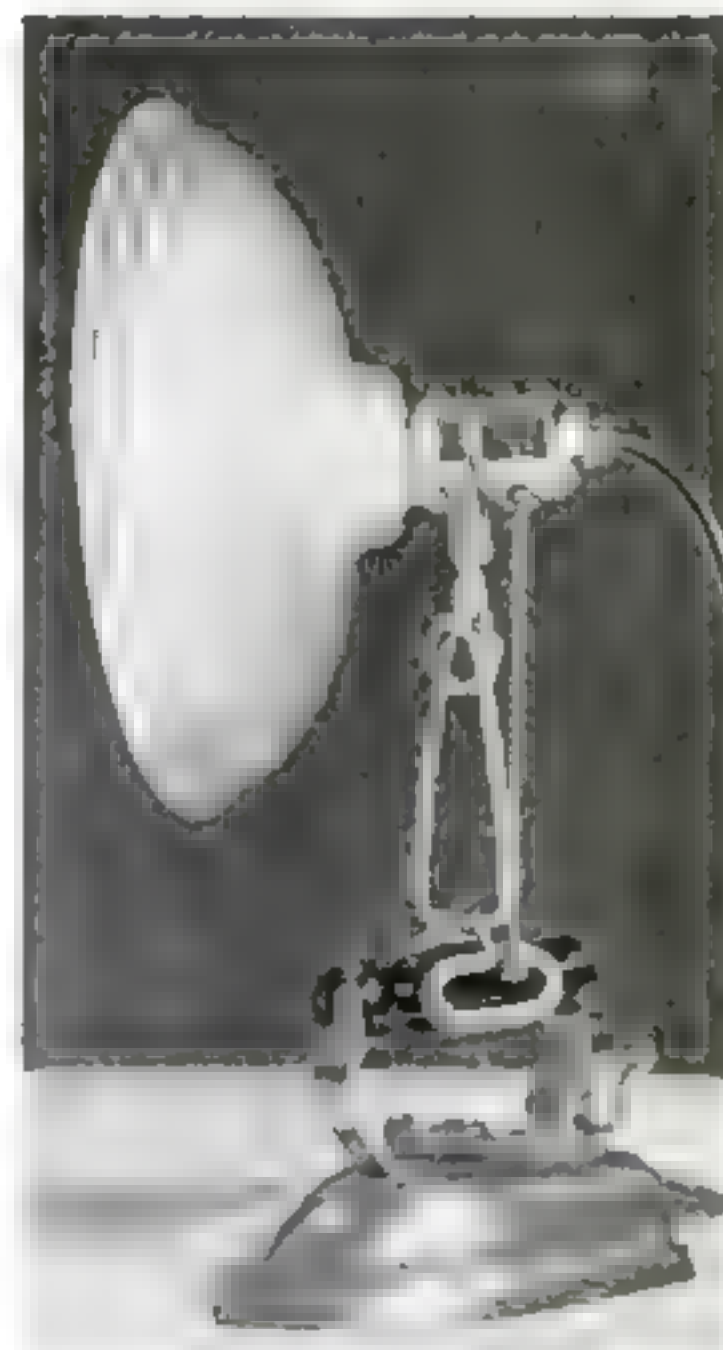


Wax Paper Protects Sleeves

CHEMICALS used in finishing photographs will not stain your shirt sleeves if each is protected with a piece of wax paper held in place with an ordinary rubber band as illustrated above.—OLIVER BANDELIER.

Electric Iron Holds Lamp for Table-Top Photos

AN ELECTRIC iron makes a substantial yet easily moved support for a lamp used in taking table-top photographs. The "clamp-on" reflectors commonly used by amateurs are top heavy and it is difficult to find a suitable place to set them up, but an iron is just the thing. To protect the table, put a piece of felt or cardboard underneath the iron. The powerful spring jaws of the clamp are merely snapped over the handle.—WILLIAM SWALLOW.



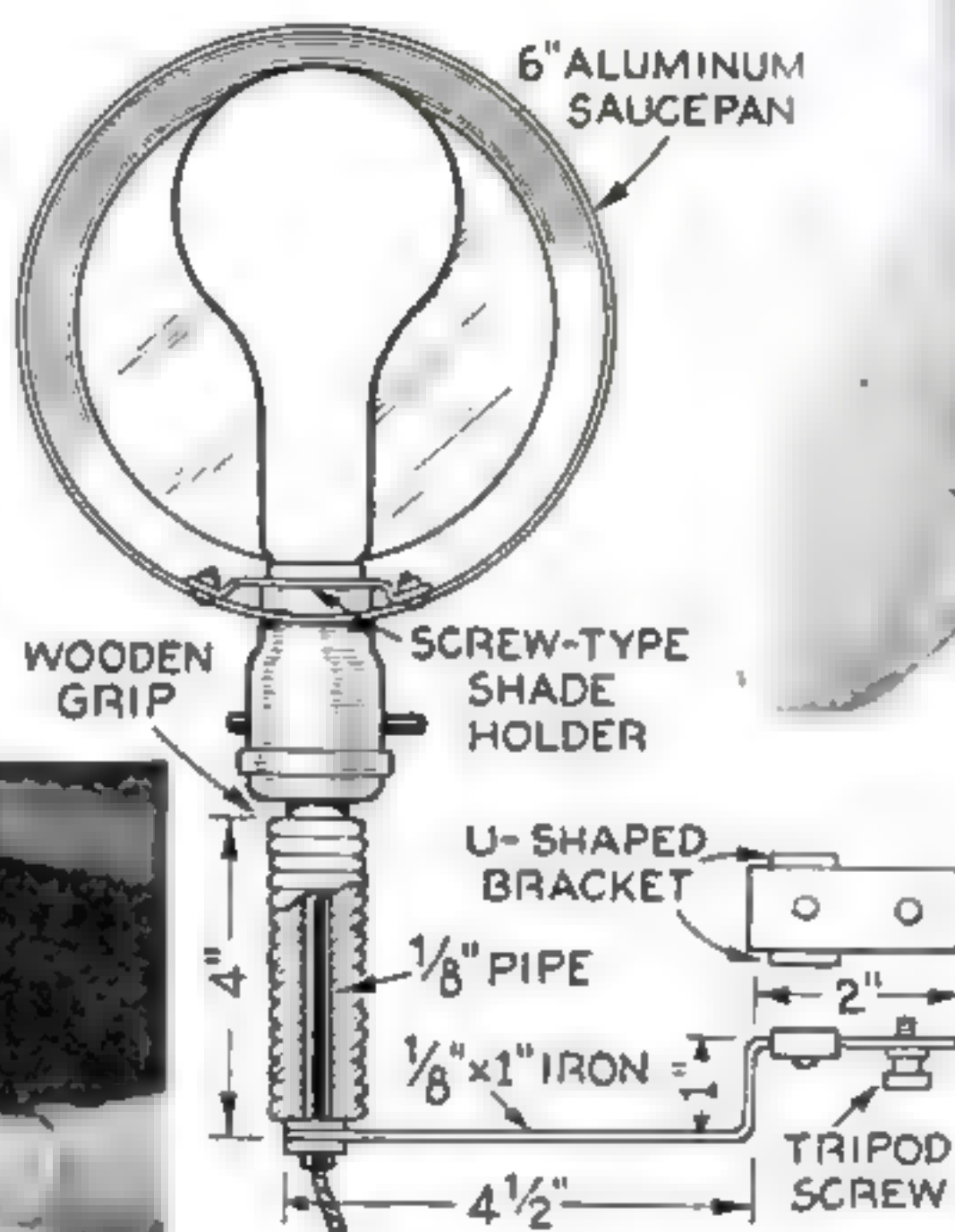
Clamped to a heavy electric iron, the reflector is no longer top heavy yet can be moved easily

A Timesaving Photoflood Bracket for Use with Miniature Camera

BY MAKING a lamp-holding attachment similar to the one illustrated at the right, the user of a miniature camera is enabled to carry his flood light with him when he makes indoor photographs. The camera and lamp may either be held or mounted on a tripod. This location of the lamp gives a rather flat lighting effect and will be found useful in photographing small groups such as at a party or in a play, especially when a number of shots have to be made in various locations without waste of time.—WESLEY O. WALKER.



Time can be saved when labeling bottles of photo chemicals by using a wax negative-retouching pencil or china-marking pencil



The attachment is made as at the left. It is used for photographing small groups

Bottles Marked with Wax Pencil

A WAX negative-retouching pencil or a china-marking pencil provides a quick way of temporarily labeling bottles of photographic developer and other chemicals. If the glass is clean and dry, it is an easy matter to write letters and figures on it with the pencil. The inscription is waterproof.—E. W.

MOUNTING PRINTS

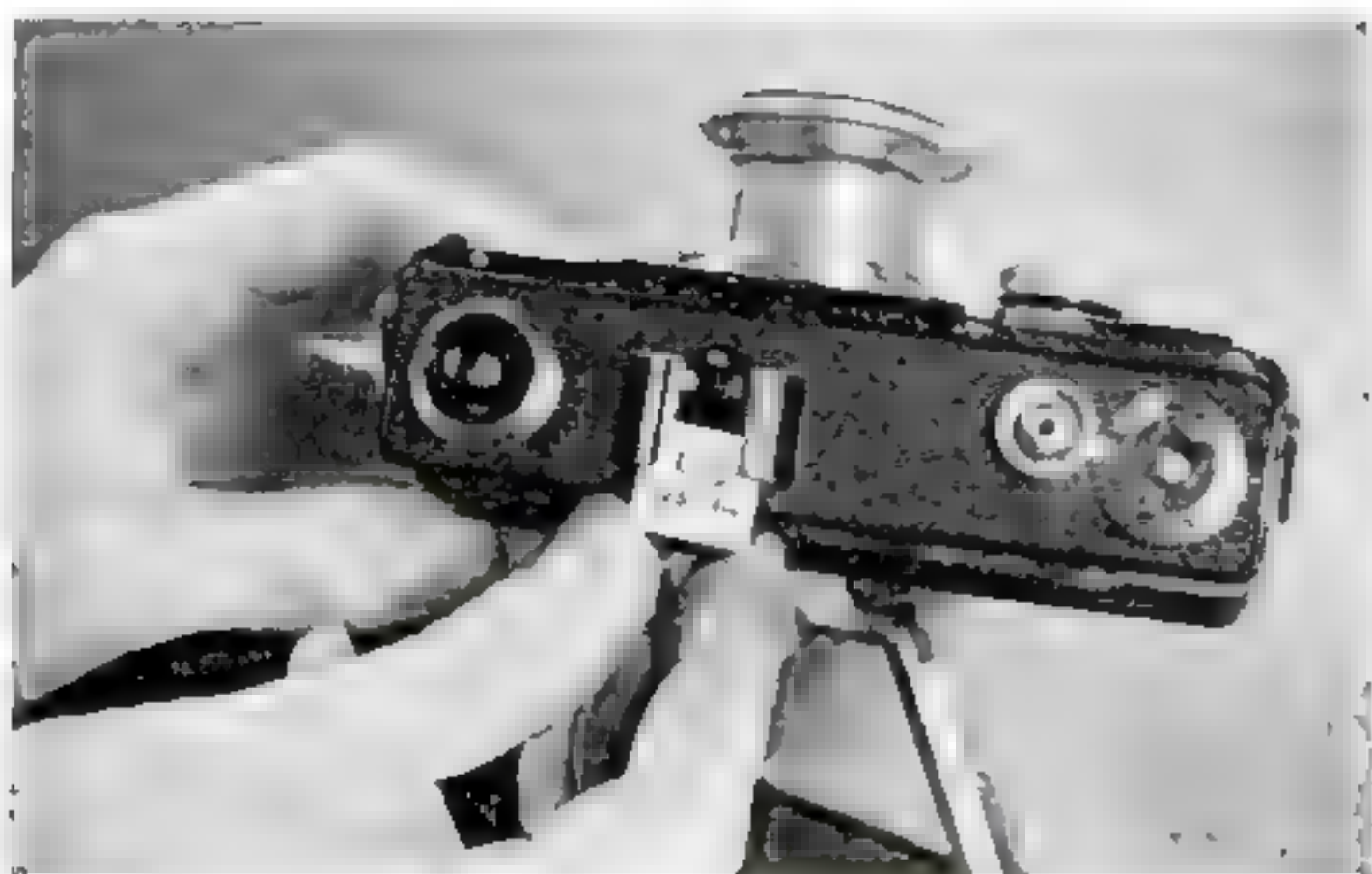
[PHOTOGRAPHY]

Mounting tissue. For home use, heat may be applied with an electric iron hot enough to give a faint sizzle when tested with a wet finger. "Tack" tissue to back of print with the iron, then trim both print and tissue to size. Place on the mount, cover with a sheet of white paper, and press with the iron. Don't slide it back and forth. About ten seconds in each position will be sufficient. Too hot an iron will glaze the print. Prints over 8" by 10" should be mounted in a professional type press.

Rubber cement. Use only the crystal-clear grade intended for paper. Coat back of print and print area on the mount liberally. Let dry fifteen minutes or longer, then squeegee the print on the mount. Remove surplus cement with an art-gum eraser or a roll of clean cloth.

Paste. No special precautions are necessary unless the paste you are using tends to buckle the prints. In that case, try applying it only to the margin of each print. Dry under pressure.

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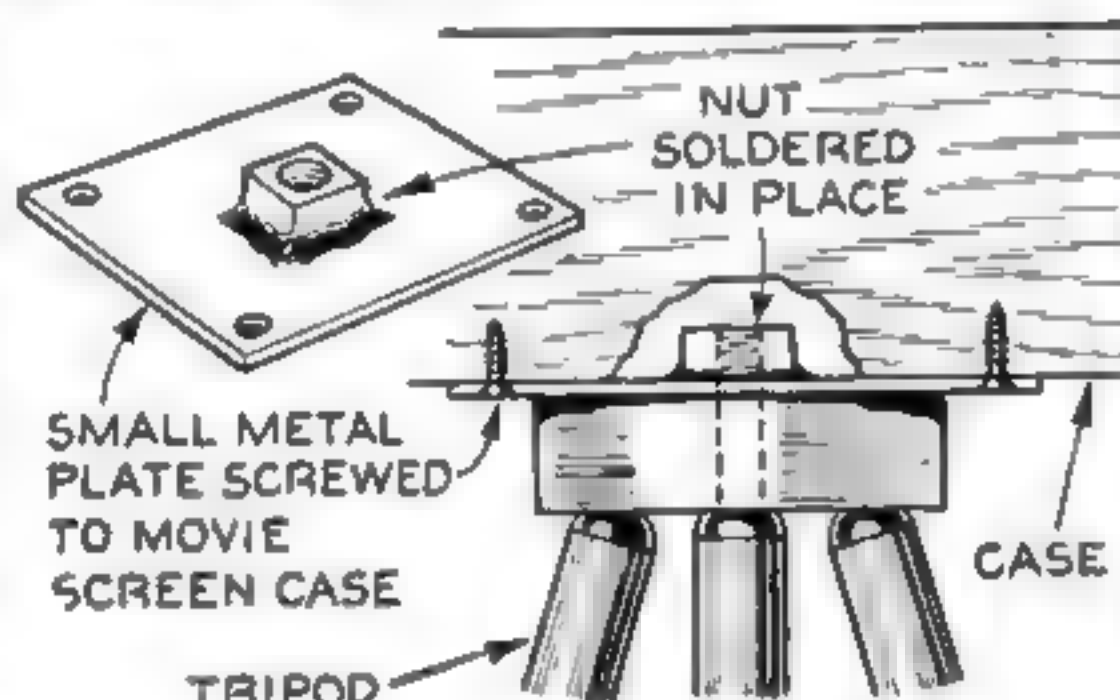
Miniature Camera Labeled to Show Kind of Film

THE accessory clip on a miniature camera is a convenient place to carry a label denoting the film with which the camera is loaded and its speed. The label can be a small piece of cardboard or heavy paper folded once or twice. A piece of cardboard provides space for two kinds of film, while folded paper can be used to record up to half a dozen identifications.—W. E. B.

Camera Tripod Provides Stand for Home Movie Screen

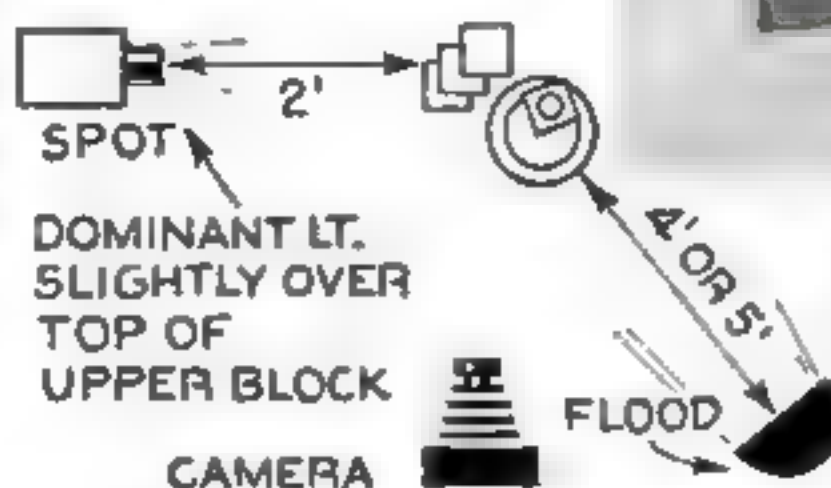
ANY sturdy camera tripod can be adapted to serve as an excellent stand for a home movie screen. Because of its height, it is especially useful for displaying movies to large groups. The tripod legs enable the screen to be sloped forward slightly to give a good view to all those in the room and also permit focusing sharply because the projected light strikes the screen surface evenly.

For attaching the tripod to the screen case, a piece of sheet metal about 2" square is drilled in the center, and a stove-bolt nut of the proper size to receive the tripod thread is soldered to it as shown. A shallow hole to take the nut is made in the case, and the plate is attached with four wood screws. The plate does not interfere with use of the screen off the tripod.

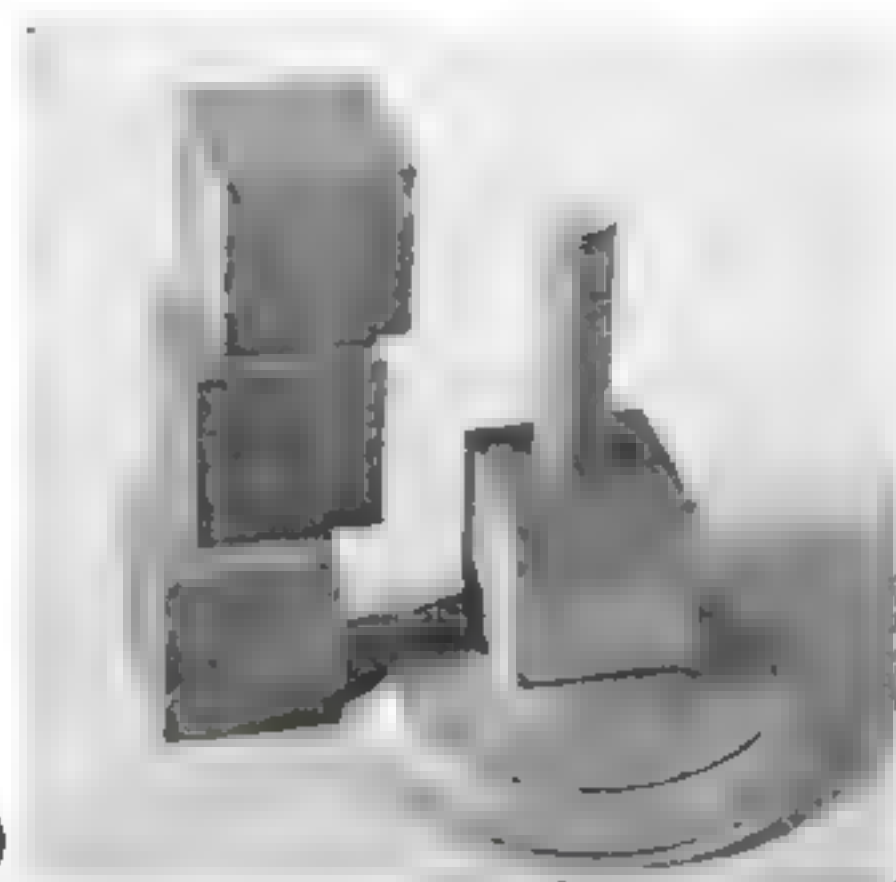


LIGHTING TO REPRESENT SHAPES

In representing shapes photographically for still-life, catalogue, or technical photos, use only the dominant light to set up the scene. Arrange it to illuminate two facets of the objects (here the side and top) so that they reflect varying amounts of light to the camera. The secondary light is used only for shadow density control and, in this case, is about level with the top of objects. Fine results often may be obtained, as in this example, by having the facet in shadow facing the camera.



[PHOTOGRAPHY]



Objects lighted, as in diagram at left, to show the planes or facets

POPULAR SCIENCE MONTHLY SHOP DATA FILE



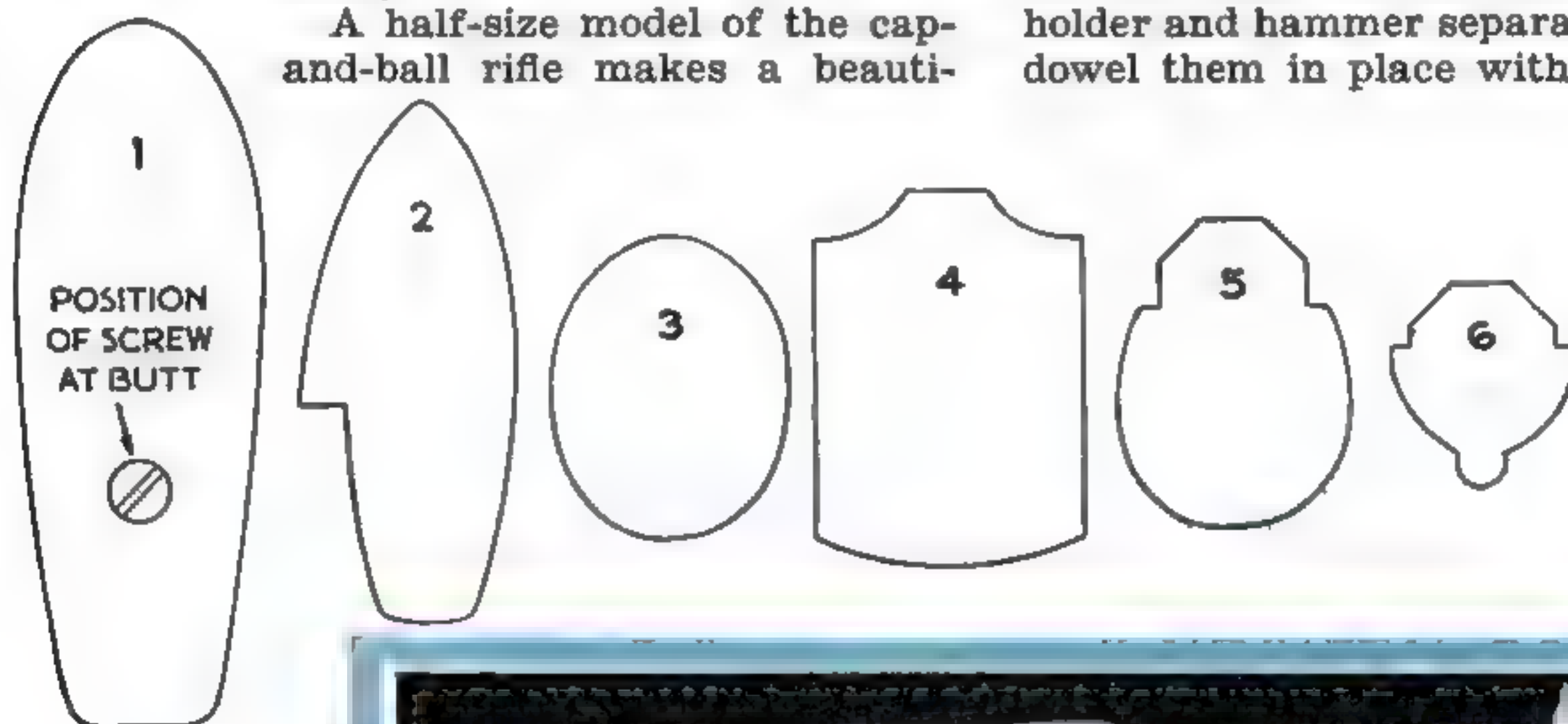
EARLY American history contains many references to the famous Kentucky rifle. The gun was approximately 5' long and had a comparatively small bore, which made it possible to carry a large amount of ammunition on journeys. Many pioneers used the long rifle for that reason, and Daniel Boone is often given the credit for promoting its popularity. After his return in 1770 from the region that became Kentucky and Tennessee, he stressed the importance of carrying rifles on trips into that wild country.

For nearly 100 years the rifle remained unchanged except for slight variations and it was often accurate up to 200 yards. Then the flintlock action was superseded by the percussion-cap type. Many of the old rifles were altered, as the change could be made easily.

A half-size model of the cap-and-ball rifle makes a beauti-

ful piece to add to your collection of whittled guns. The one described is copied from an authentic rifle on which the name of the maker, Jos. M. Golcher, was inscribed. From the stock butt to the end of the barrel is one piece of wood—usually curly maple. The elaborate brass inlay on the right side of the stock was hinged so that small round pieces of buckskin heavily greased with soft tallow, which held the bullets in place, could be kept inside.

Enlarge the drawings and transfer them to a piece of white pine 1" by 5" by 2' 6". Jigsaw the excess away, leaving just the outline. Start by whittling down the thickness. From the full-size cross sections make cardboard templates to help obtain the correct shape. Keep your pocketknife very sharp so that it will not tear the soft wood. Make the cap holder and hammer separately; then glue and dowel them in place with a piece shaped to



Use these full-size cross sections for making templates to guide the shaping. The numbers refer to points indicated on the drawings on the following page

Close-up view of stock, trigger, trigger guard, and hammer. The imitation hinge projects 1/32" beyond the stock



By CARL G. ERICH



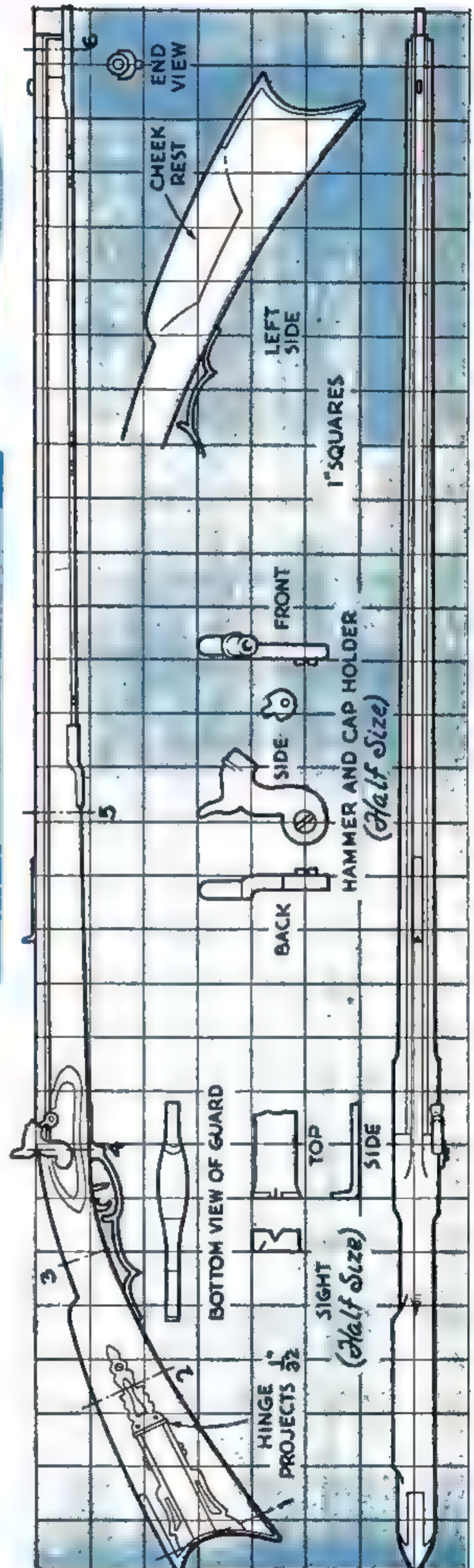
Carving of the trigger should be left until last. Keep the knife sharp at all times so it will not tear the soft wood

represent a screw. Note that the rifle has an octagon-shaped barrel and there is a cheek rest on the left side of the stock.

Bore a small hole in the end of the barrel to make it appear to be hollow. A long rifle when new was usually about .45 caliber—sometimes even as small as .32 caliber—but would be rebored whenever the bore became badly worn and rusty. The result was that the older the rifle, the larger the bore.

Outline the markings and the brass inlay with a very small veining tool or any tool that will produce a narrow V-cut.

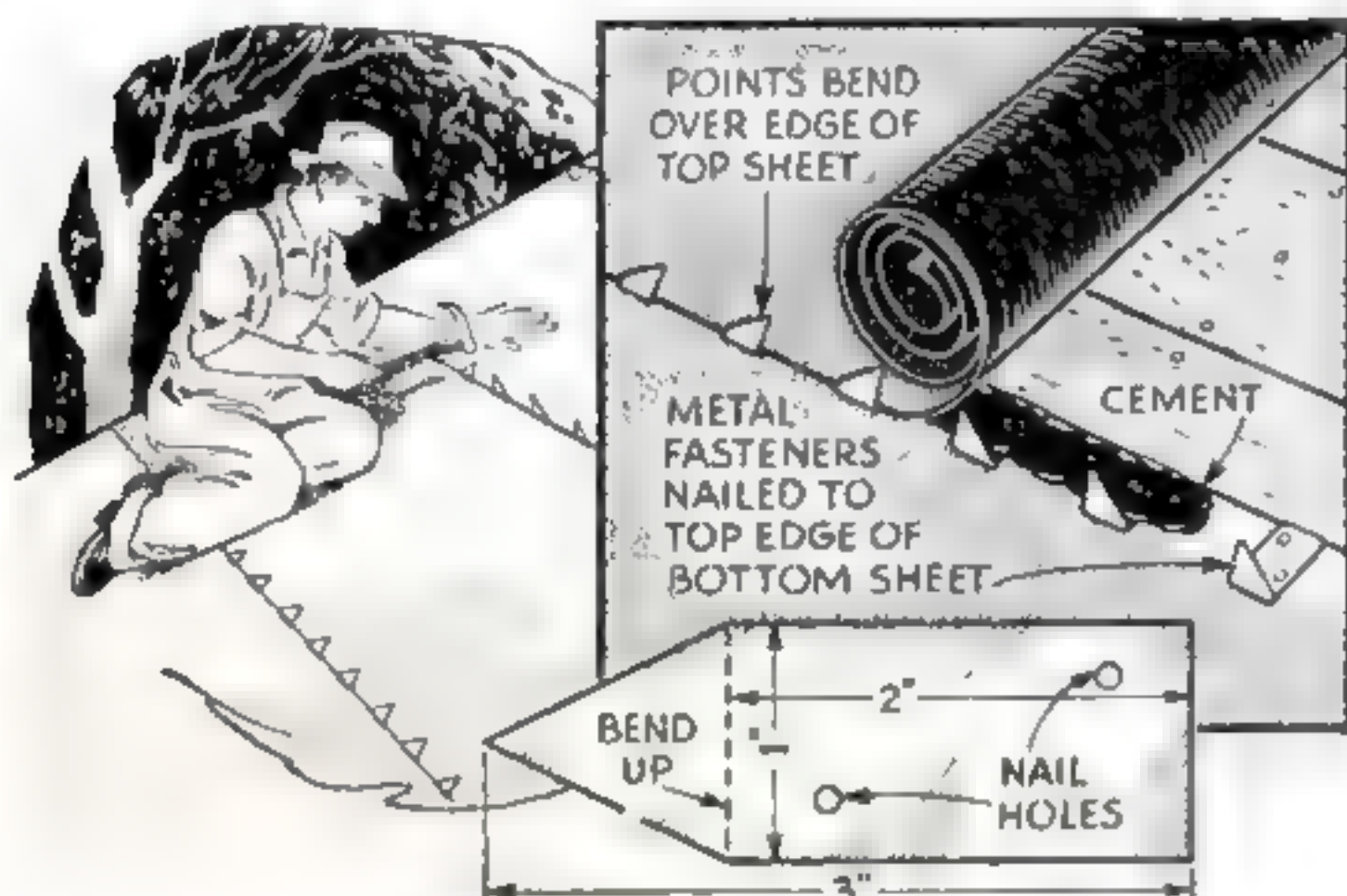
The model illustrated was left in the natural wood, but it may be finished with stain and paint if desired. Stain the wood parts antique maple, paint the iron parts gun metal and give a dull gold finish to the brass parts. The model may be mounted, if desired, on a baseboard, preferably walnut or mahogany.



Metal Fasteners Prevent Leaks in Roll Roofing

FOURTEEN years ago I put on a roof with heavy roll roofing paper and it has never leaked. This is because I used fasteners of the type illustrated below instead of roofing nails, as leaks usually start around the nails.

The fasteners are cut from galvanized iron. Two small holes are punched in each, and the pointed ends are bent up at right angles. The roofing paper is laid across the roof, and the fasteners are nailed about 3" apart along the upper edge with shingle nails. Roofing cement is applied in a strip 2" wide, covering the fasteners. The next length of roofing paper is laid to overlap 2", and the fasteners are hammered lightly down over the top sheet. This process is continued until the roof is covered. Roofing nails are used only at the beginning and the end of each strip.—H. I. OSTELEE.



Cleaning Lathe Tapers

FOR accurate work on the lathe, the tapered hole in the spindle must be kept perfectly clean. This can be done with a cleaning rod made by inserting a screw eye in the end of a wooden dowel. The cloth is then passed through the screw eye.—H.R.H.

Copper Wool Removes Gum

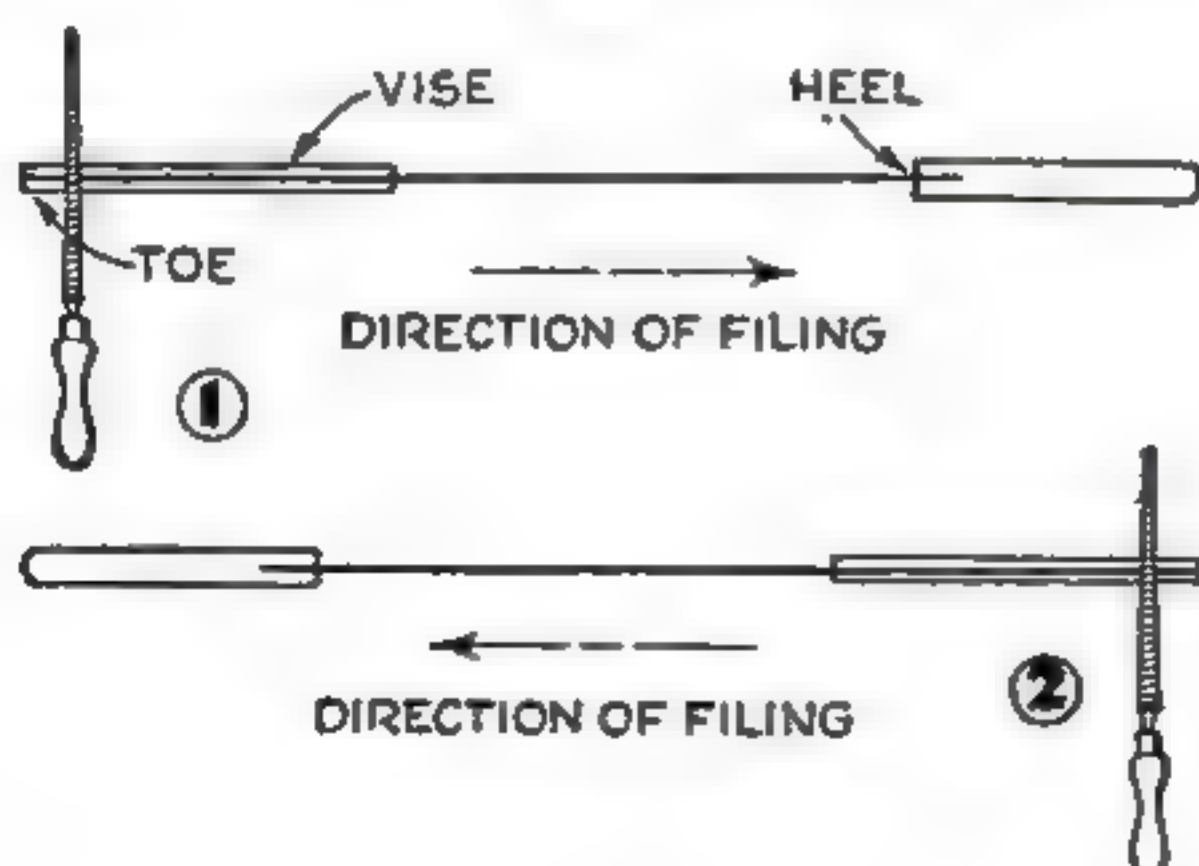
THE gummy residue left on woodworking machine tables by wood having a large pitch content may be removed easily with an ordinary scouring pad. The copper wool type is best because it does not scratch.



FILING A RIPSAW

[WOODWORKING]

1. Joint the saw lightly and clamp it in a saw vise with the handle towards the right. Hold the file

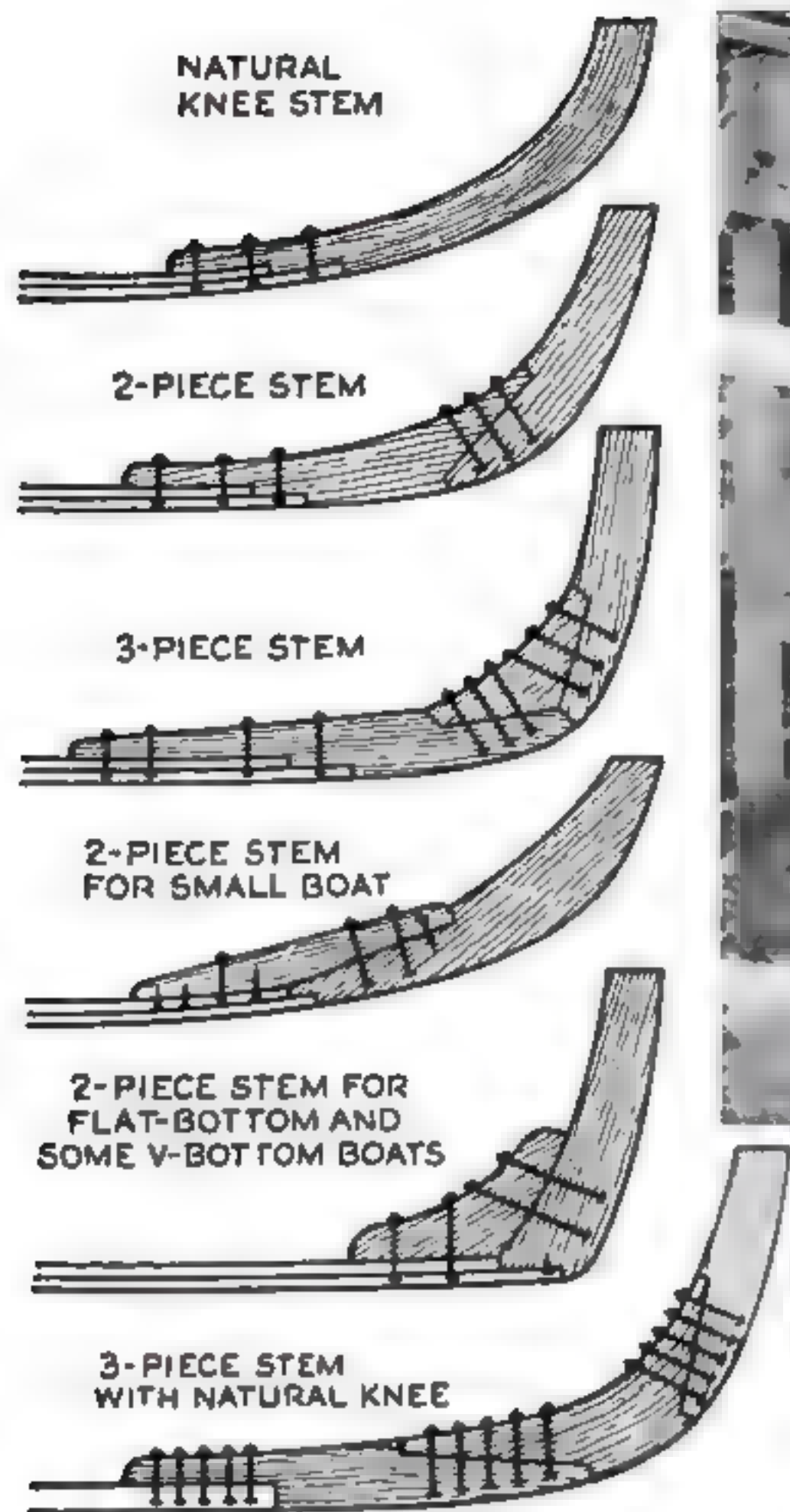


horizontally and at right angles to the blade.

2. Start in the first gullet to the right of the first tooth set away from you and continue in every second gullet until the handle is reached. Reverse the saw in the clamp and file the gullets previously skipped.

Files. For rip saws and crosscut saws with 4, 4½, 5, 5½, 6, 6½, and 7 points to the inch, use 7" slim taper files. For 8- and 9-point crosscut saws, use 7" extra slim taper files. For 10- and 11-point crosscut saws, use 5" extra slim taper files.

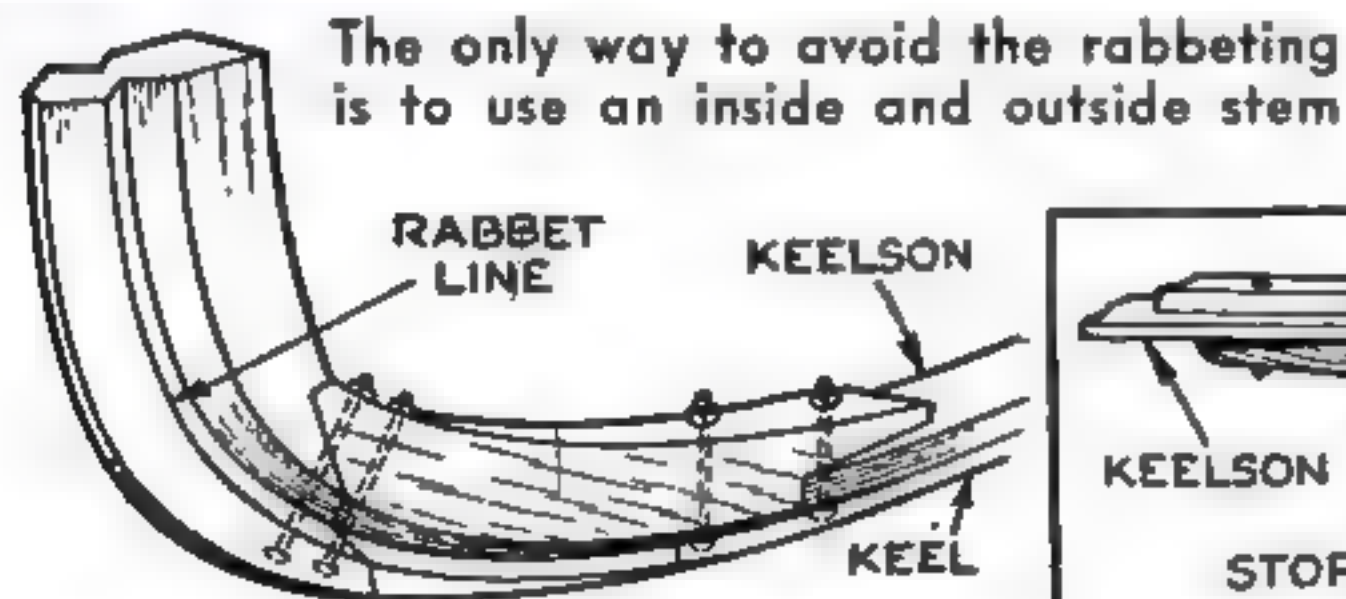
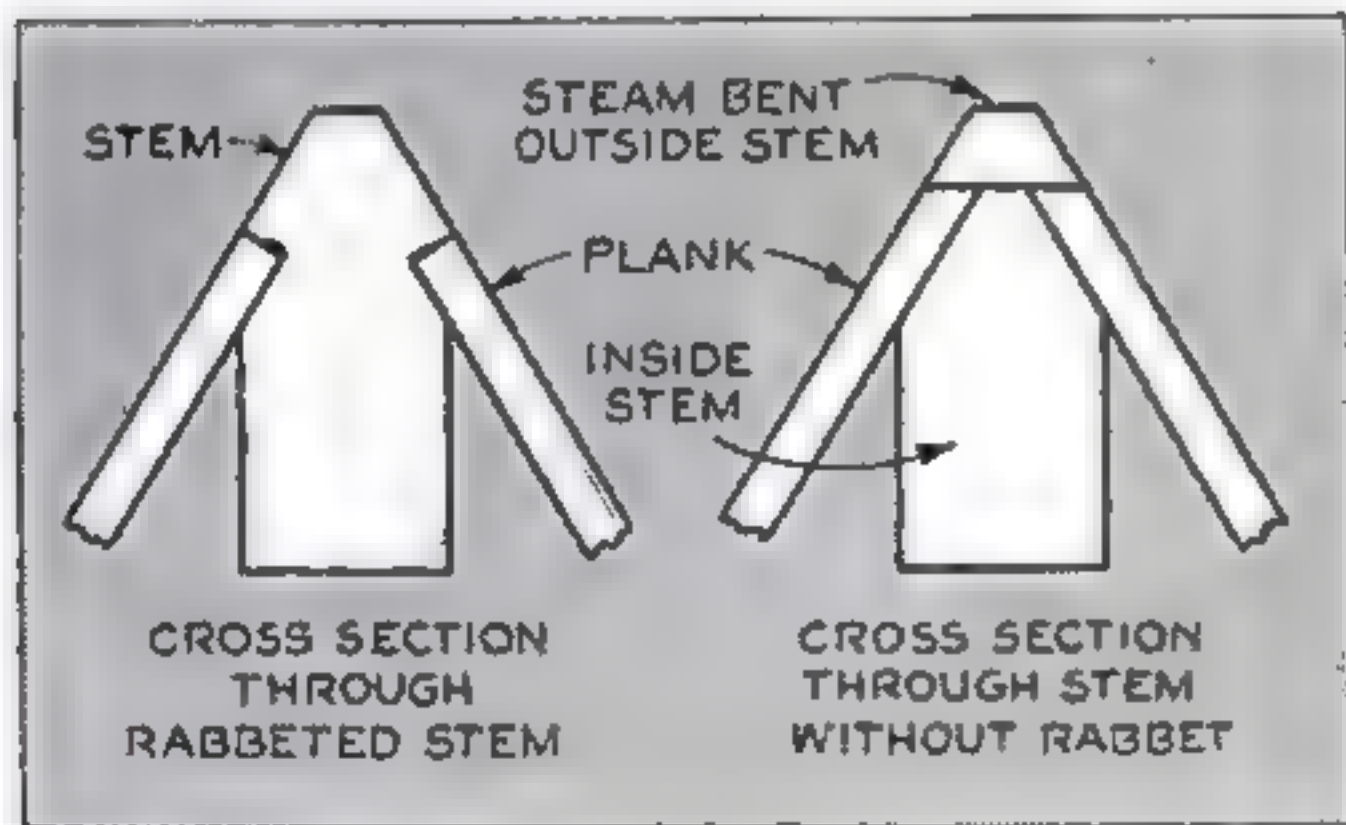
POPULAR SCIENCE MONTHLY SHOP DATA FILE



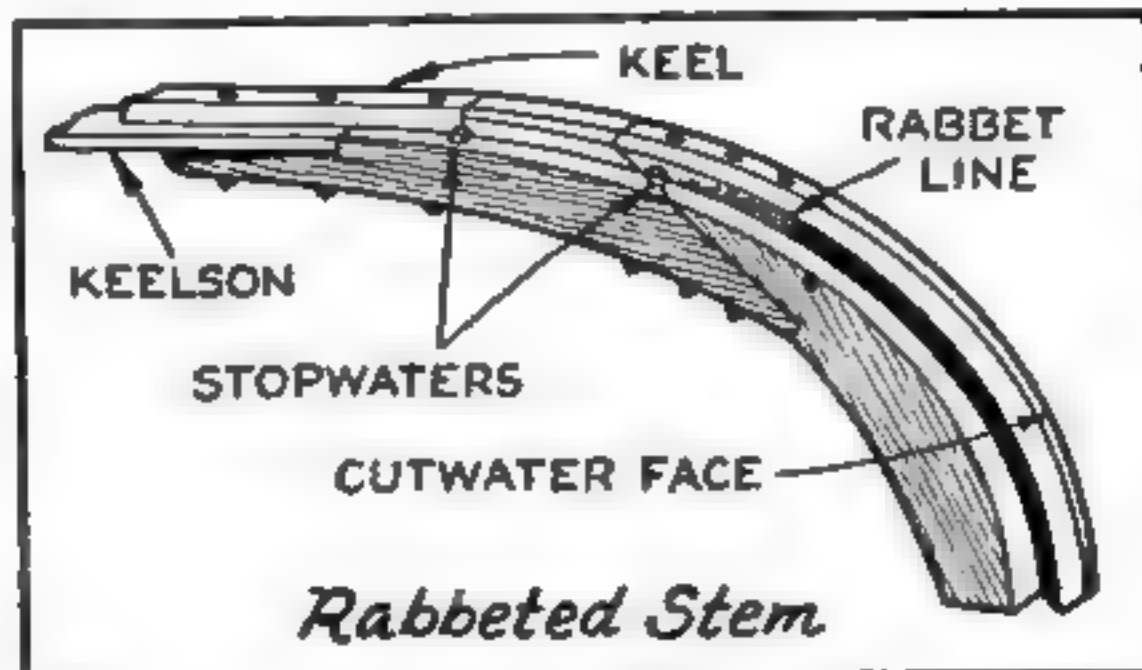
Stems are made in various ways, as shown at left. Amateurs usually find it easier to rabbet the stem after it has been set up in place

Stem Construction

FOR SMALL BOATS



How stem sections are fastened. Wherever a rabbet crosses a joint, it is necessary to use a stopwater



THE stem of a small boat may be made in many different ways, depending upon the size of the boat and the particular design. Ordinarily a one-piece stem is used only when the boat is very small or when a natural crook knee is available such as a hackmatack (tamarack) knee.

Two- and three-piece stems are usually made of white oak. Hard pine or mahogany may be substituted, and spruce is often used for a very light boat. A full-size paper pattern for such a

stem must first be drawn; it is used to determine the shapes of the various pieces and as a guide while fastening them together. The scarfs where the various parts join should be carefully fitted and made long enough so that plenty of fastenings can be used. The joining surfaces

By **BRUCE and WILLARD CRANDALL**

should be painted before fastening.

After the stem is assembled, the rabbet line is marked on each side. The bearing line may also be drawn if it appears in the plans, and the rabbet may be cut roughly in the stem while it is still on the bench, using the measurements from the plans if they are given. If a full-size drawing of the entire boat has been made, it is possible to work out all the rabbet angles from this drawing, but it is a very complicated process and requires considerable knowledge of drawing and projection.

It is easiest for most amateurs to cut the entire rabbet after the stem is set up in position on the boat. A batten the same thickness as the planking can then be bent over the frames and clamped into position at various points to act as a guide for the rabbet angles and depth, or a short piece can be used to gauge the depth. If desired, test notches can first be cut into the the stem at various points. All the notches are joined together later to form the continuous rabbet.

On most boats the stem rabbet is continuous with the rabbet in the keel or with the groove made by the overlapping of the keelson by the keel. On small boats in which no outside keel is used, the rabbet disappears near the end of the stem; from this point



Aside from the stem, even a boat like this is not very hard to build

back the two garboard planks fit against each other.

At every point at which the rabbet crosses a joint in the wood, a hole should be drilled through the stem and a soft wood plug or stopwater driven through. The soft wood will swell under water and keep the joint tight.

Ahead of the rabbet line, the stem is planed to a V-shape to form the cutwater. This may be done as soon as

the stem is assembled or later on.

In many cases it is possible to do away with the necessity of cutting any stem rabbet by making the stem of outside and inside pieces. The inside piece is simply planed so that the planking will fit over it properly, and the outside piece is bolted to it after the boat is entirely planked. This method also eliminates the difficulty of fitting the planking ends to the rabbet, as the planks are allowed to run past the inside stem until after they are fastened; then they are sawed off flush just as they are at the transom. After the planking is completed, the front of the inside stem and the planks are planed off smooth and coated with marine glue before the outside stem is fastened in place. If a steam box is available, the outside stem may be made from a relatively thin piece of oak, bent instead of sawed to shape. This makes the strongest and lightest type of construction.

Tiny Spinning Wheel Holds Thimble and Pincushion

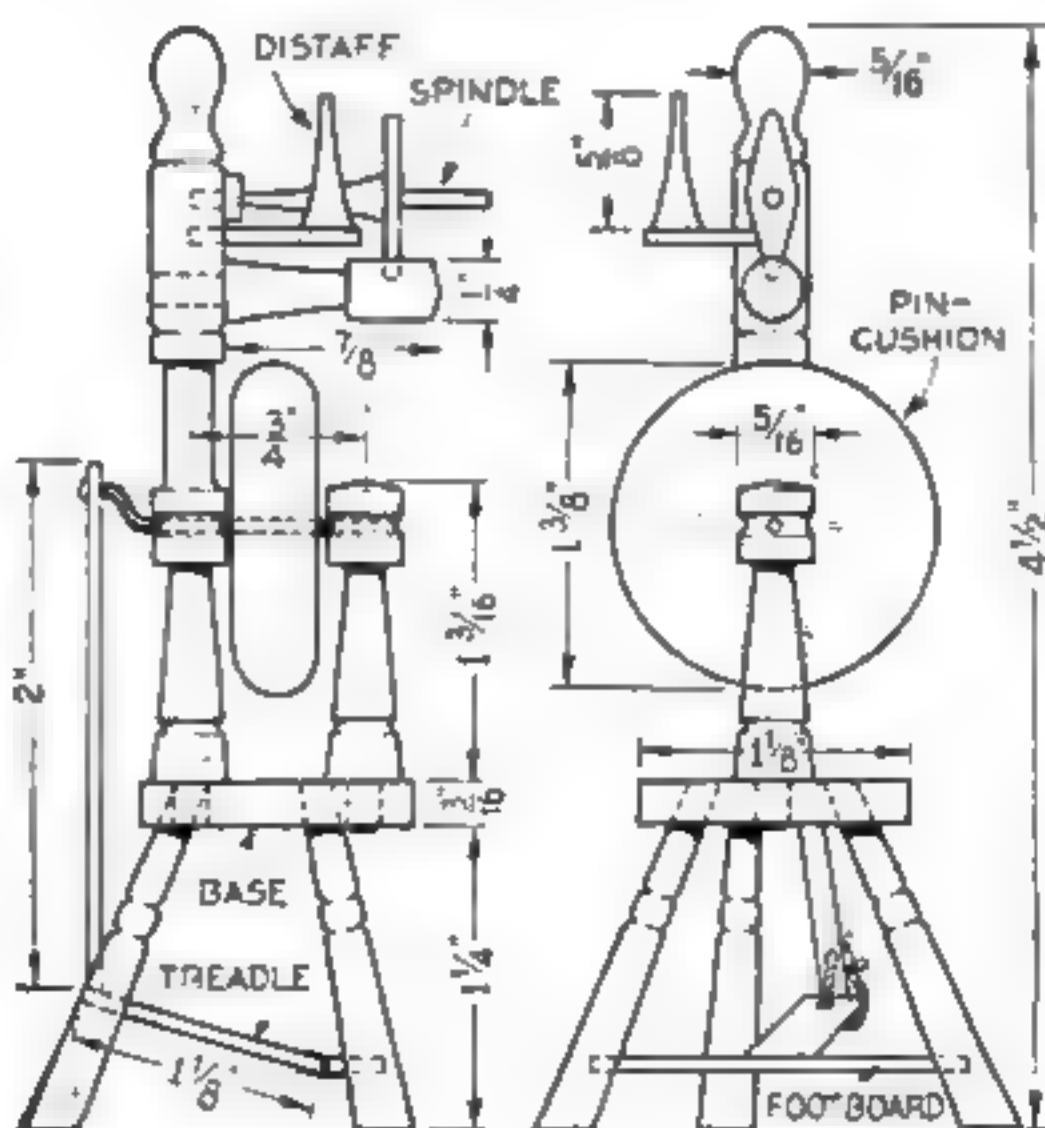


The wheel of this novel little sewing kit is a pincushion. The thimble is placed on top, and a small spool may be tucked underneath on the treadle

THIS miniature spinning wheel serves as a thimble rack and a pincushion. Meat skewers, disks cut from wooden poles, and some scraps of thin box wood are used for the various parts. The necessary holes may be either drilled or burned in with hot wire nails. The treadle is hinged to the footboard at one end with a piece of glued cloth, and is attached at the other end to

a crank made by bending a pin. The two parts of the treadle are linked with a loop of thread or fine wire.

The pincushion is made by gluing some padding on both sides of a wooden disk and covering the whole with two round patches of black velvet. Represent the spokes with stitches of thread.—
RICHARD J. MAURO.





Designed to hold two milk bottles, this box is strongly built of wood and lined with pieces of insulating board to keep out the heat and cold

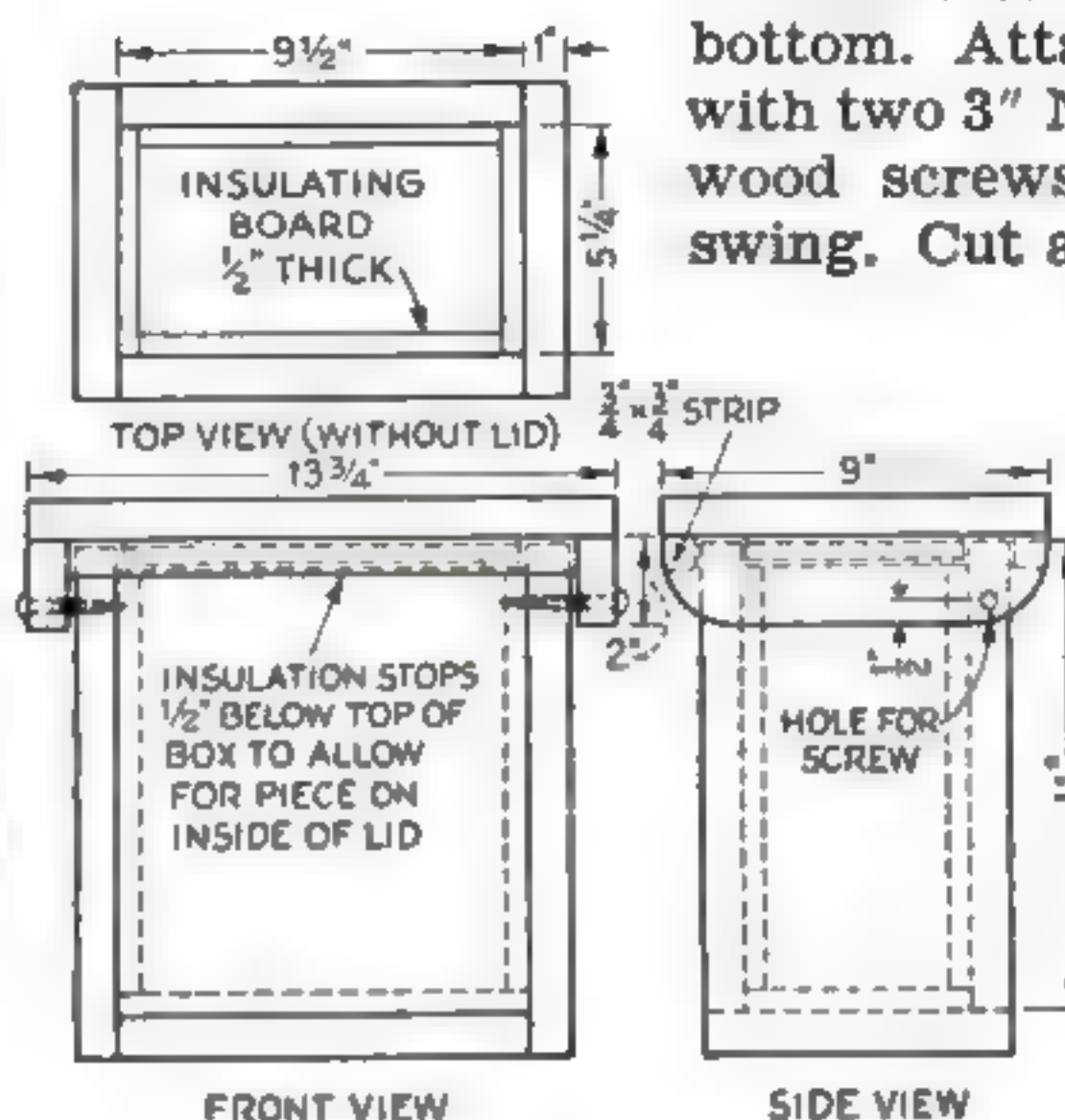
Milk Bottles Protected in Box Lined with Insulating Board

MILK bottles, if placed in this insulated box when delivered, are protected against the weather, breakage, and stray animals. Even when the milk is left outside for a considerable time, the box keeps it from freezing in the winter or becoming sour in summer.

The box shown holds two one-quart bottles, but it could be made larger if necessary. The wood parts are nailed together first, then $\frac{1}{2}$ " thick insulating board

is nailed to the inner sides and bottom. Attach the assembled lid with two 3" No. 8 roundhead brass wood screws, which allow it to swing. Cut a piece of the insulating board to fit and

nailed it to the inside of the lid, placing it so it will not interfere with opening or closing the lid. Paint or varnish the finished box thoroughly to protect it against the weather. The wood for the box is 1" thick.—C. B.

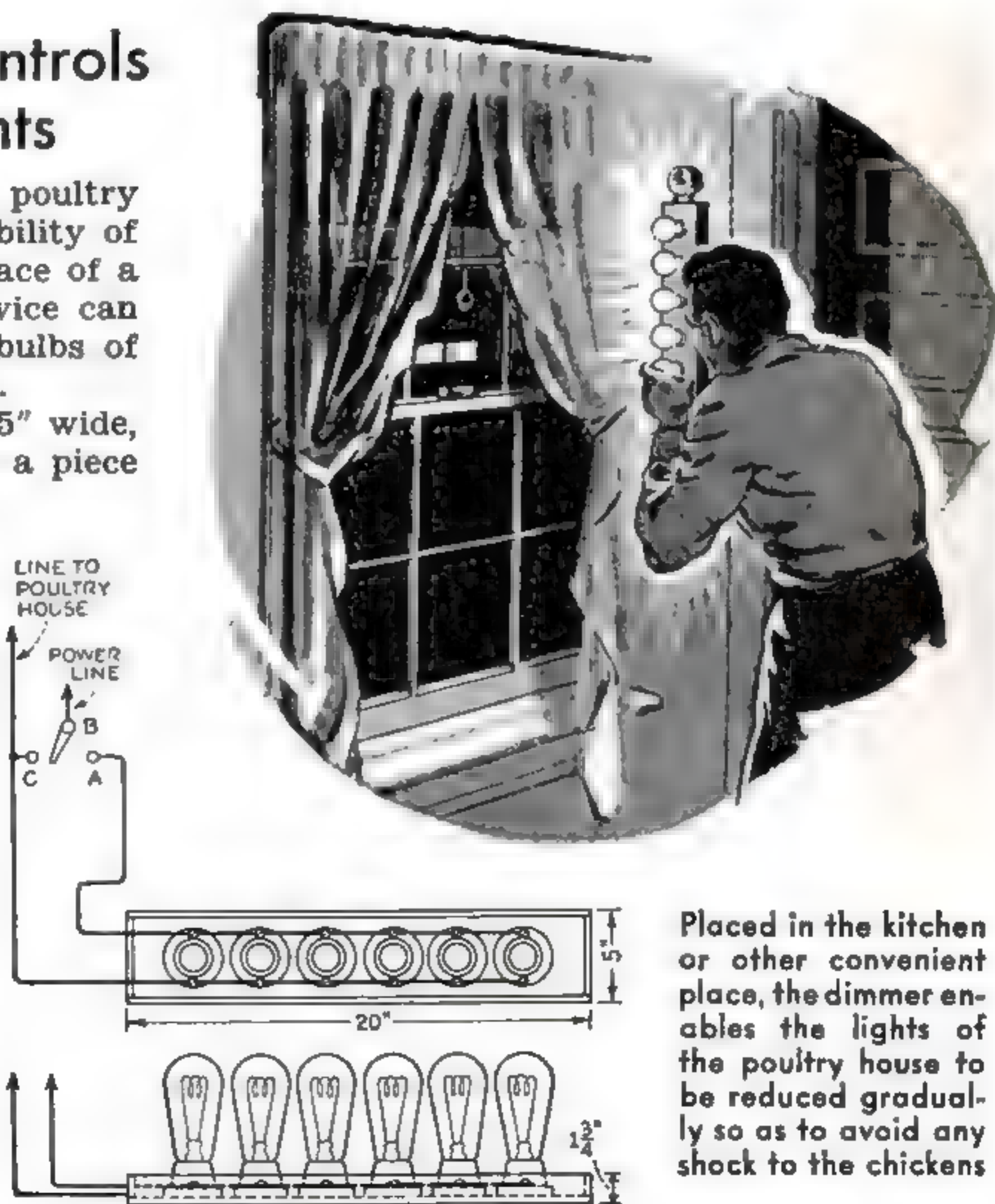


Low-Cost Dimmer Controls Poultry-House Lights

CHICKEN raisers who use lighted poultry houses are well aware of the desirability of dimming the lights gradually. In place of a choke coil, an excellent dimming device can be set up with six carbon-filament bulbs of 16 candlepower, connected in parallel.

The sockets are mounted in a box 5" wide, 20" long, and 1 3/4" deep. The lid is a piece of $\frac{1}{8}$ " pressed composition wood with six holes through which the sockets project. All connections are soldered and a switch is connected as indicated.

For full illumination, the switch is set from *B* to *C*. To dim the lights, screw all six bulbs firmly in the sockets, then throw the switch from *BC* to *BA*. The bulbs will light and the lamps in the poultry house will become slightly dimmed. By unscrewing one bulb at a time at about five minute intervals, the poultry house lights will be gradually dimmed to a deep shade of twilight, and the current can then be turned off entirely.—FRED H. SCHULTZ.



Placed in the kitchen or other convenient place, the dimmer enables the lights of the poultry house to be reduced gradually so as to avoid any shock to the chickens

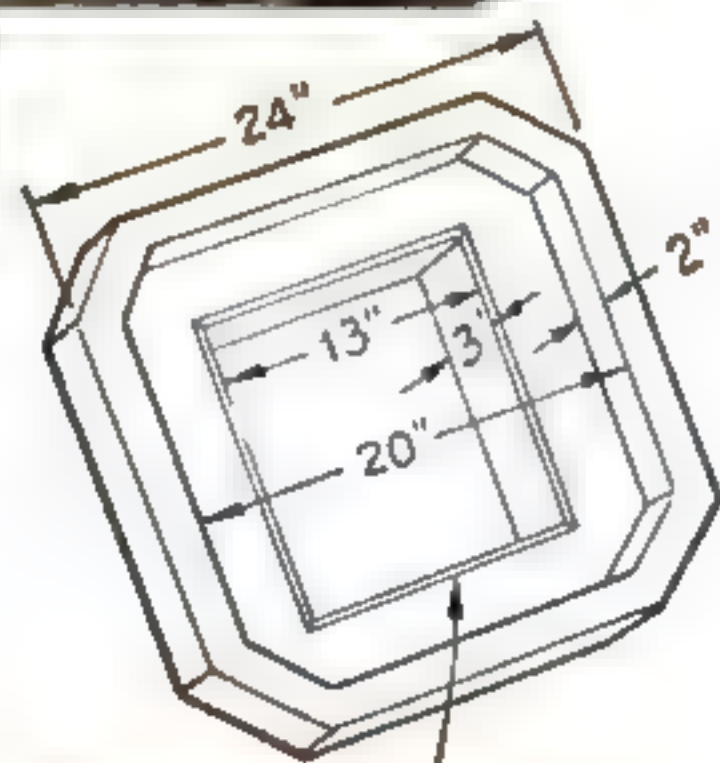
Space-Saving Accessories



While the vise at right is tied up with a gluing job, an auxiliary woodworking vise is mounted in the metal-working vise at the left



This tool tray, which is easy to lift around, is arranged so the tools are in convenient groups



$\frac{1}{2}$ " QUARTER-ROUND LIP PREVENTS TOOLS FROM ROLLING OFF TERRACE

INCREASED enjoyment from the use of tools can be gained by constructing shop accessories like those shown in the accompanying illustrations. They are designed to help the home workshop owner maintain a clean, convenient workshop.

The tool tray prevents frequently used tools, such as screw drivers, wrenches, and pliers, from accumulating on a bench top and thus impairing its usefulness as a working surface. The tray also serves for carrying these tools to where they are needed and provides a regular place to store them in plainly visible groups.

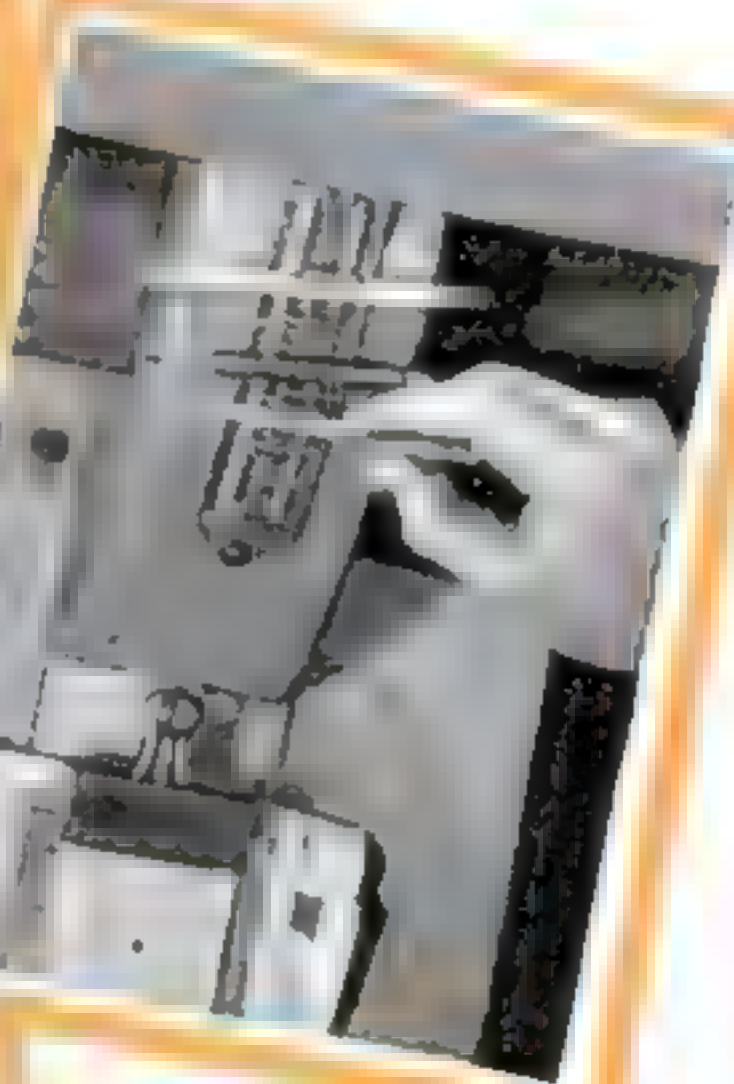
Note that the bottom is recessed to make the tray easy to grasp for lifting, and the interior is terraced so as to permit the desired grouping of tools. A deep well, suitable for containing large tools, is formed in the center of the tray. Durability is assured by using 2" by 2" stock for the risers and rail-

By
J. MODROCH

for a Small Workshop



Left, refilling small oil cans from the shop supply, which is kept in one-gallon cans. Below, the curved pencil rack



troughs built around three sides of the wagon, which can be pushed about the shop at will. Reached through doors at the rear, the interior of the wagon serves as a storage compartment for housing bulk quantities of these items. Visibility in the troughs is increased by light reflected down into them from the white painted walls of the wagon. As a convenience for supporting the overhanging ends of long boards being worked on the bench, the wagon is built bench high, while the dolly base with its four casters is removable for general trucking use.

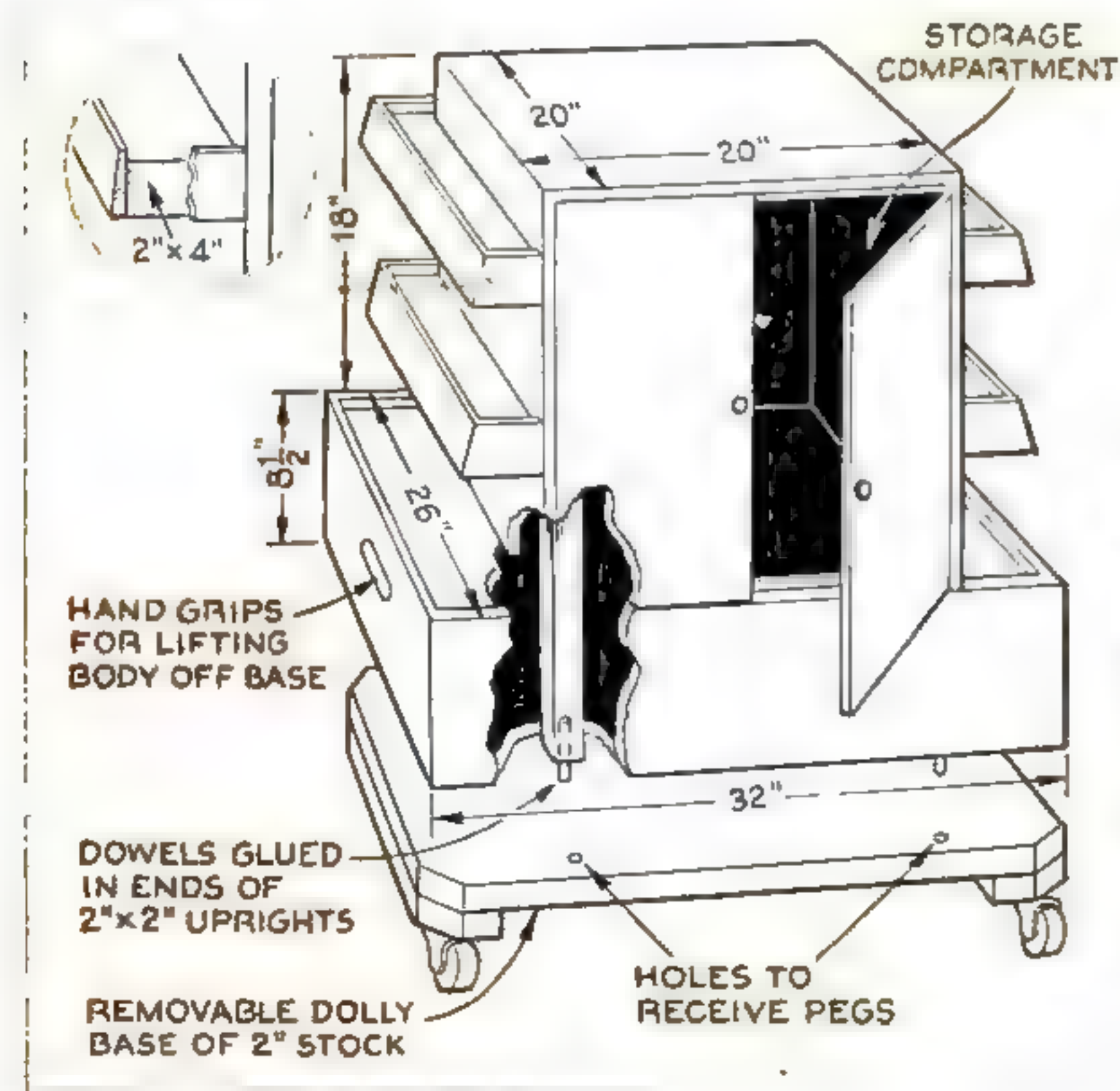
The choice of bench vises can be increased without consuming any additional bench space by bolting auxiliary vises on blocks in a manner suitable for clamping them in the jaws of the one

ing, and 1" boards for the bottoms of the well and terrace. Painting the interior white makes it still easier to select any desired tool at a glance.

The nail-and-screw wagon is another aid. Boxes of nails, nuts, screws, and washers may be arranged in any desired order in the

or two vises that are permanently fixed on the bench. Thus, with one woodworking vise and one metal working vise and an auxiliary of each type bolted on blocks, a working combination of either two woodworking vises or two metal-working vises is possible.

This arrangement proves especially useful



for converting a large vise into a small one in order to hold small work conveniently. It also permits the conversion of either vise to the other type, should the regular vise become tied up, as for instance, while being used to aid in clamping up a glued job.

Gallon-size oil cans held in a wall rack, as shown, aid in keeping the oil supply accessible. If spigots are soldered into the bottoms of the cans, the chore of refilling small

containers can be done quickly without removing the storage cans from the rack. To identify the various kinds and grades of oil, the cans may be numbered or painted in different colors.

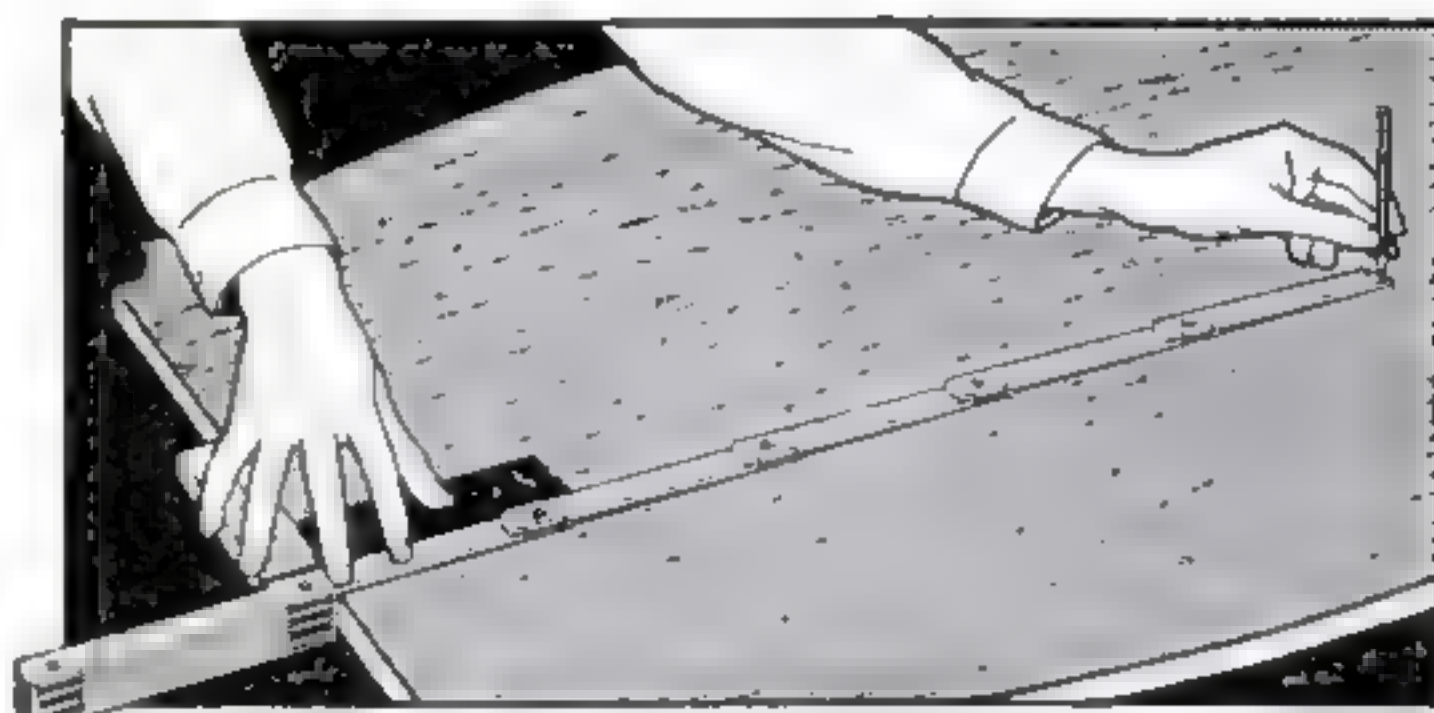
It will be found that a pencil holder of the wire-spiral type can be made more accessible if mounted on a curved block, as illustrated, instead of being held flat. Place the holder within easy reach of the woodworking vise.

Faucet-Reseating Tool Used in Hand Drill



WHEN reseating a faucet with the special type of tool commonly used for that purpose, much better results will be obtained if it is turned by means of a hand drill, as illustrated at the left. To do this, remove the handle of the tool, grip the shank in the drill chuck, and screw the guide collar into the open end of the faucet. This method leaves a smooth, even surface, free from chatter marks resulting from hand operation.

—S. J. GANCHER.



Try-Square Aids in Laying Out Long Work with Folding Rule

GREATER accuracy in making a long measurement in from the edge of a large panel can be assured if a try-square is held against the folding rule as illustrated.

Setting Up Work To Be Welded

SHORT, discarded ends of electrodes are useful for setting up and "tacking" work that is to be electrically welded. The short pieces are easier to handle for this purpose than long rods.—F. J. W.

STANDARD VARNISH STAINS

[PAINTING]

Varnish stains are sold ready mixed. For general use, keep on hand cans of mahogany, walnut, and oak varnish stains, and clear varnish of the same make. Do not buy an opaque or pigment type of varnish. See that the wood is sanded glass smooth and free from scratches, then proceed as follows:

1. Seal the wood with one part white shellac, one part orange shellac, and five parts denatured alcohol. Brush on evenly. Dry hard. Sand with No. 6/0 garnet finishing paper and dust carefully.

2. Use any required combination of varnish stains to make up the desired shade. For example, old cherry can be mixed from one part mahogany varnish stain, three parts walnut, and one part clear varnish.

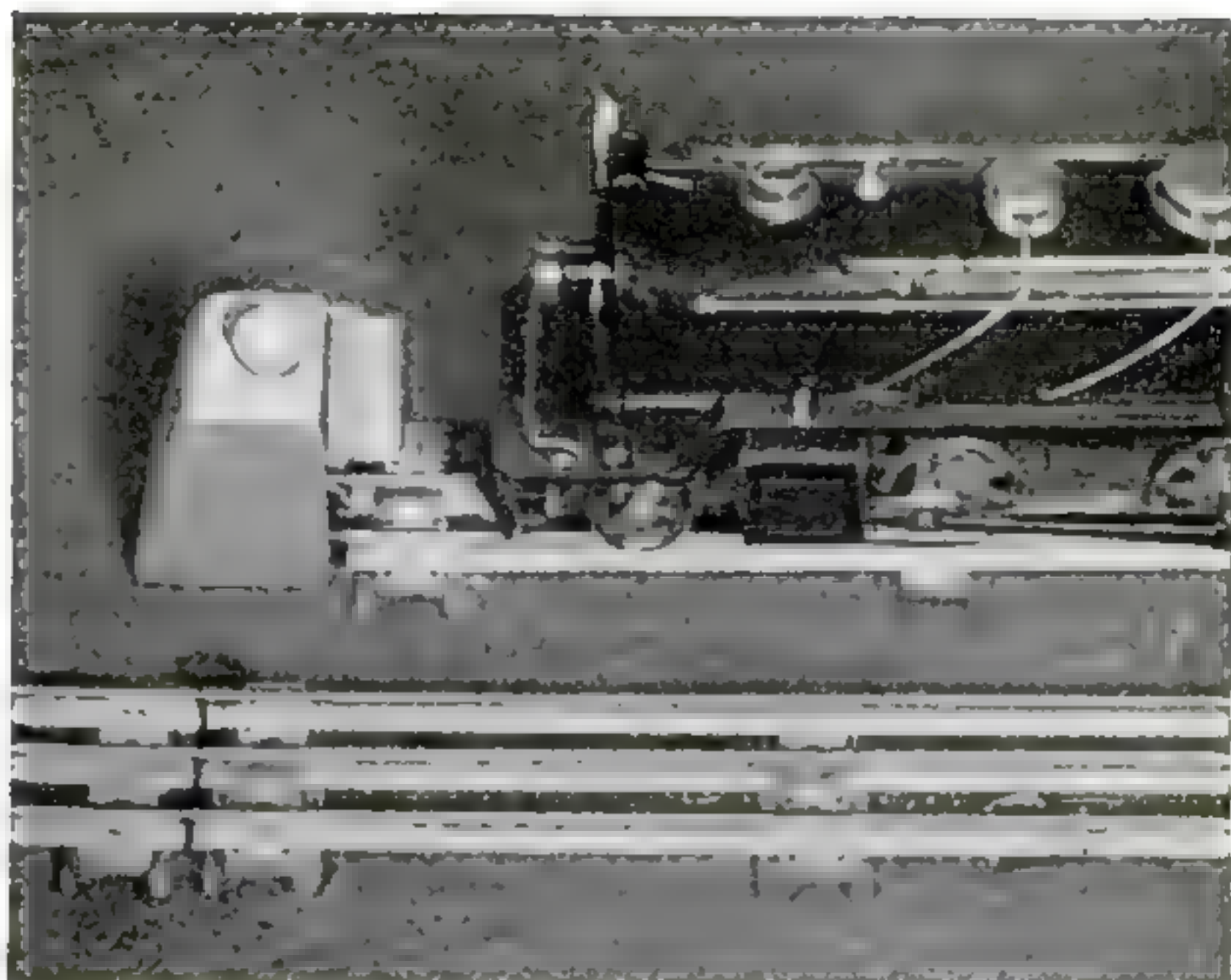
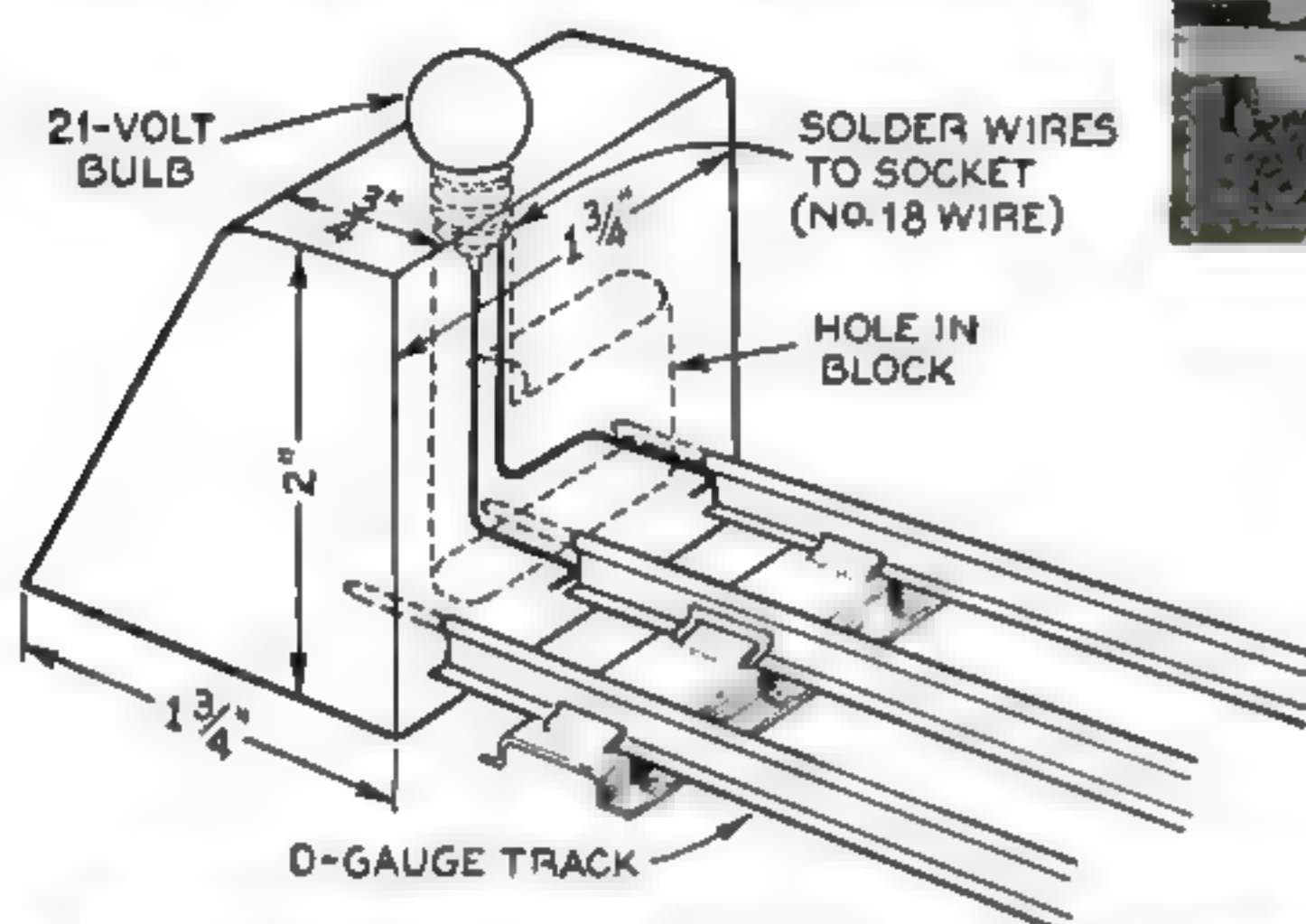
3. Apply the freshly-mixed varnish stain with a fitch brush very evenly. Do not lap the strokes. Dry for twenty-four hours and repeat to deepen the color if necessary.

4. Apply one clear varnish coat. Dry for a week. Rub in the usual way with FFF pumice stone and oil or water for a fine finish.

POPULAR SCIENCE MONTHLY SHOP DATA FILE

ILLUMINATED Model Railway Bumper

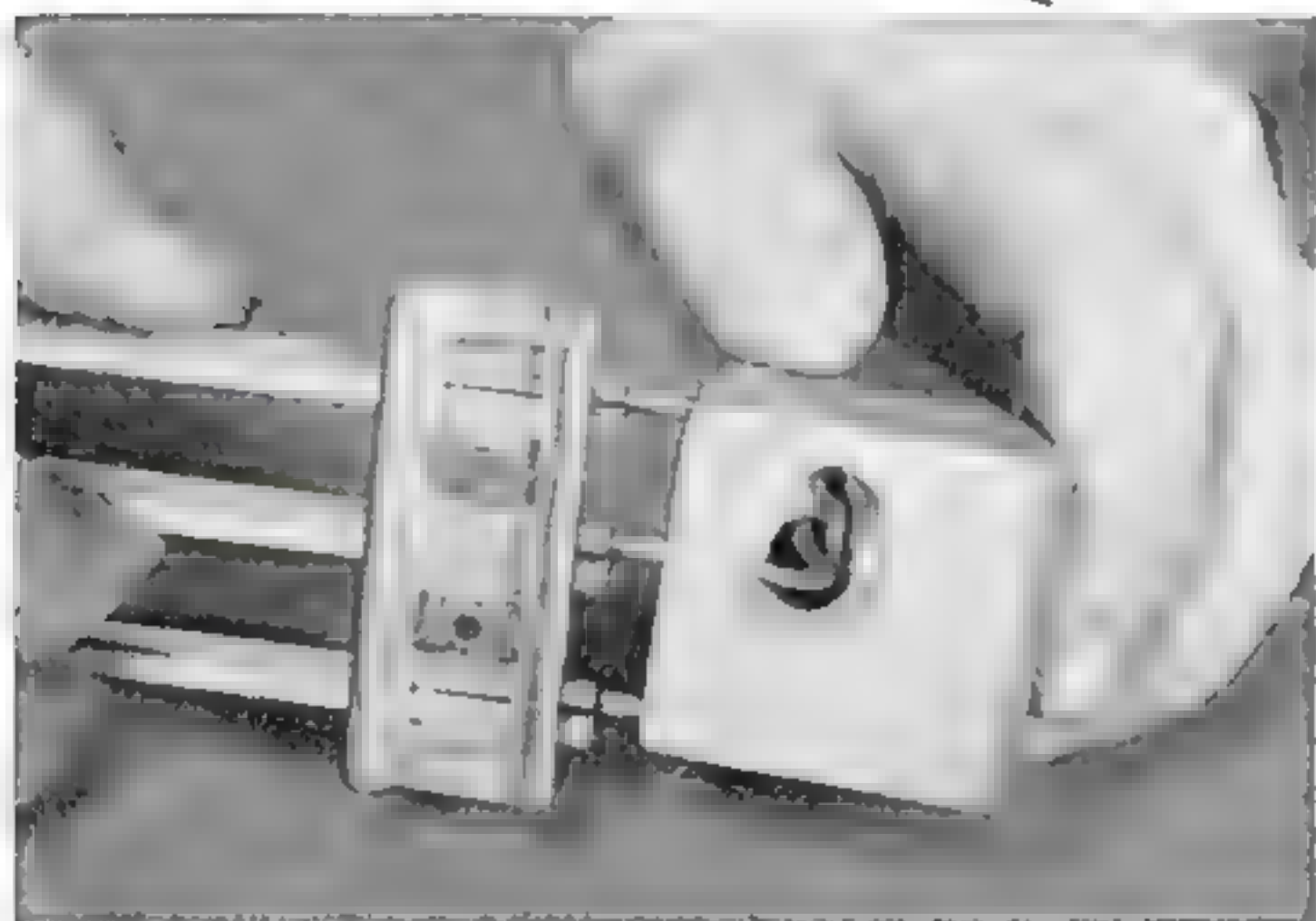
GIVES WARNING
OF SHORT CIRCUITS



BESIDES preventing derailments, this illuminated bumper for model-railway use acts as a danger signal. When the light shines very dimly or not at all and an engine is on the siding, it indicates that something is wrong and you should investigate the trouble to prevent burn-outs.

In a block of wood shaped as in the sketch, drill three equally spaced holes in the lower part of the front to take the track pins. Bore another hole from the top all the way through the block to fit a bare miniature socket. Enlarge the bottom of this hole to give access to two of the small holes made for the track pins.

Solder wires to tip and side of the socket and push it down in the hole so the bulb will touch the top. Bring one of the wires out through the center hole and the other out through a side hole. When the bumper is pushed on the track, contact is made and the bulb will light when power is on. Paint the bumper gray and use one at the end of each siding.



Miniature Detour Sign for Railroad Layout

Patterned after the typical road barricade you meet when motoring, the detour sign shown at the right is made from strips of cigar-box wood. If scaled to suit an O-gauge model railroad layout, the length should be 4", the height 1", and the spread of the legs about 1 7/8". All the strips are 1/4" wide, and the legs are set 1/4" in from the ends. Glue the pieces together and paint the sign gray or white. When the paint is dry, use black drawing ink to letter "DETOUR," "ROAD CLOSED," or any other suitable warning on the crossbar of the barricade.—C. ELMER BLACK.



Readers Find 45 Mistakes

IN WOODWORKING CONTEST

FORTY-FIVE errors were hidden away in the nine photographs published in connection with our woodworking-mistakes contest (see P.S.M., June '39, p. 142), but no contestant discovered them all. Each mistake, however, was detected by at least three or four contestants, and almost every one noticed several very glaring errors. The winning entry received a score of twenty-four points out of a possible forty-five.

Hundreds of readers participated and there were humorous as well as serious answers. One person said that if the craftsman did that many things wrong, the final picture should show him covered with bandages and in bed. A reader from Palestine seemed more con-



cerned as to whether the machinery had been properly oiled than he was in finding the actual mistakes. The majority of the contestants received ratings of approximately twelve points.

FIRST PRIZE, \$25

H. G. Louthan, Renwick, Iowa

SECOND PRIZE, \$15

C. A. Bradford, Jackson Heights, N.Y.

THIRD PRIZE, \$5

Walter F. Debold, Alameda, Calif.

\$1 PRIZES

D. D. Gurnee, Brooklyn, N.Y.; M. A. Hiller, Brooklyn, N.Y.; Leo M. Knasky, Detroit, Michigan; Paul G. Lackey, Washington, D.C.; James B. Leeth, Birmingham, Ala.; William Parsons, Wilson, Pa.

HONORABLE MENTION

H. C. Applegate, Troy, Ohio; E. E. Bartlett, Jr., College Station, Texas; Dr. C. A. Beck, Indianapolis, Ind.; Boyd H. Bingham, Muskegon Heights, Mich.; G. Blakely Bisset, Savannah, Ga.; Edward Blythyn, Glenshaw, Pa.; Charles Bloss, Siebert, Md.; Earl M. Boner, Cleveland, Ohio; Thomas Bonomo, Freeland, Pa.; Brooks Crislip, Spencer, W.Va.; Lee R. Brown, Whippany, N.J.; Daniel Clendaniel, Brownsville, Pa.; Charles C. Doolittle, Harbor City, Calif.; William T. Eggers, Milwaukee, Wisc.; L. J. Gier, Buies Creek, N.C.

G. J. Hardy, Knoxville, Tenn.; Vincent J. Henschel, Brackenridge, Pa.; L. R. Hess, Hamilton, Ont., Canada; Vernon Hutchinson, Weston, W.Va.; L. A. B. Hutton, Ottawa, Ont., Canada; Kenneth Jacob, Pottstown, Pa.; Dan Jennings, Estacada, Ore.; Thomas W. Johnston, Virginia, Ill.; H. R. Junker, Port Washington, N.Y.; W. A. Kenney, Syracuse, N.Y.; Paul Knight, La Plata, Mo.; Howard Koehler, Chicago, Ill.; J. P. MacNeill, Oakland, Calif.; Marvin E. McKinney, Colby,

Kans.; J. C. Miller, Oak Park, Ill.; Tom E. Moore, Albany, N.Y.; John Moschett, Iron Mountain, Mich.; A. G. Muehlbauer, Buffalo, N.Y.

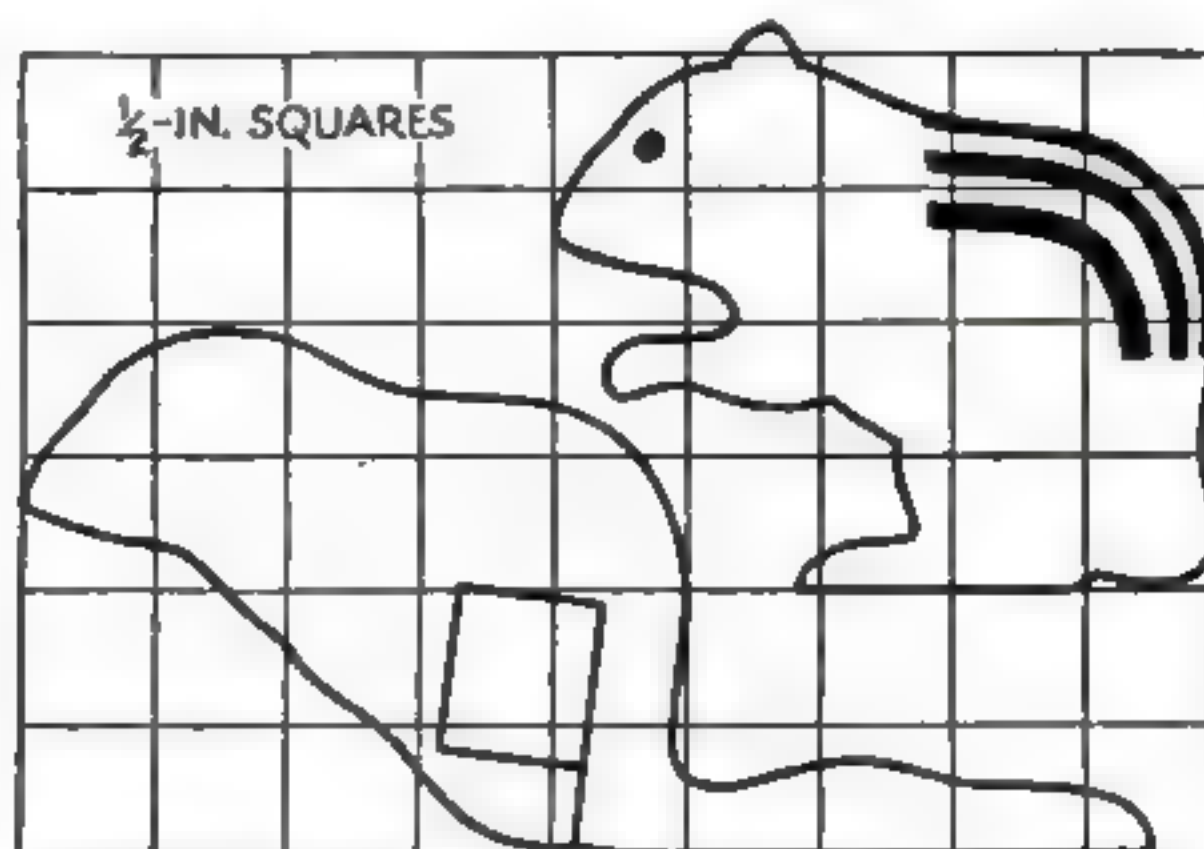
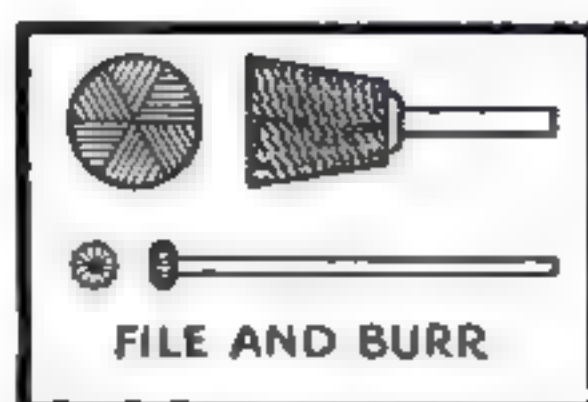
Leon J. Nowak, Brenham, Texas; Arthur I. Olson, Lanesboro, Minn.; C. L. Partin, Fort Kamehameha, Hawaii; John Paustian, Gainesville, Fla.; R. G. Phillips, Vancouver, B.C., Canada; Edward A. Pontzer, St. Marys, Pa.; Chester F. Protheroe, Chestnut Hill, Mass.; Karl Prumers, Los Angeles, Calif.; Otho Quick, Charlotte, N.C.; Oliver Remelius, Belleville, Ill.; D. C. Shirk, Wyomissing, Pa.; M. J. Slemmon, Atwood, Ont., Canada; Alvin H. Souerwine, York, Pa.; A. H. Squires, New Haven, Conn.; O. J. Stallings, Dallas, Texas.

Earl J. Stephenson, Honolulu, Hawaii; H. J. Sullivan, Burlington, Vt.; R. A. Taschereau, Mason City, Wash.; A. A. Van Rie, Mishawaka, Ind.; Elmer Verburg, Grandville, Mich.; Dr. J. R. Wainwright, Augusta, Ga.; Walter E. Wilson, Newington, Conn.; A. H. Wiltshire, Birmingham, Ala.; John W. Wolcott, Chicago, Ill.

If you are interested in woodworking errors, send a self-addressed, stamped envelope for a complete list



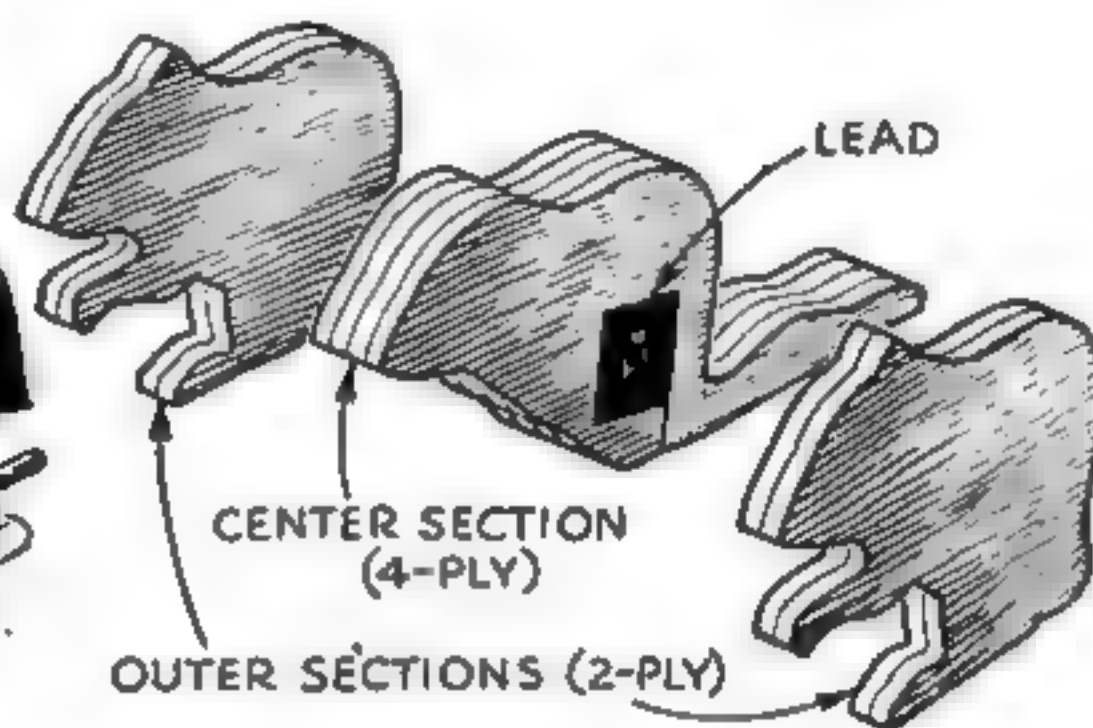
Small Lead-Filled Wooden Chipmunk Forms Distinctive Paper Weight



SEATED on his haunches, this lifelike little chipmunk acts as a novel paper weight. The tools required are a jig saw, arbor and motor-driven chuck, cone-shaped rotating file, large dental burr, and a press.

Glue $\frac{1}{8}$ " gumwood or white-wood with casein to form two- and four-ply boards, reversing the grain in adjoining layers. Leave in the press overnight. Draw the outlines on the plywood and cut out on the jig saw, including the opening in the center section.

Fill this opening with lead. Glue the sections together and drive small wire nails through them to prevent slipping in the press. When dry, pull out the nails and shape the figure by manipulating it against the rotating file mounted solidly on an arbor. Use the burr to get into the recesses. Drill holes for the black, glass-headed pins that represent the



eyes. Cut the pins to a length of $\frac{1}{8}$ ", fill the holes with glue, and push the pins into place.

Use drawing ink for the five black stripes, and color the body with reddish mahogany stain. Leave stomach, throat, and two stripes (between the lower black ones) white. Thin some ink with water and paint the tail. When dry, add black hair lines to it.—E. B. Fox.

Bicycle Spokes Brace Sagging Screen Door

A STRONG, neat-looking brace to prevent a screen door from sagging may be made by using two bicycle spokes and three narrow strips of nickel-plated metal, which may be taken from a discarded egg beater, can opener, or the like. The spokes are connected in the middle by a short, narrow piece of metal. The end brackets are bent to shape and drilled to take the spoke nipples and nickel-plated screws. Adjustment is easily made by turning the nipples with a screw driver. Being nickel-plated, this brace will not rust readily.—B. N.



The brace is neat, strong, and rust-proof. It is made from two bicycle spokes and junked pieces from nickel-plated appliances

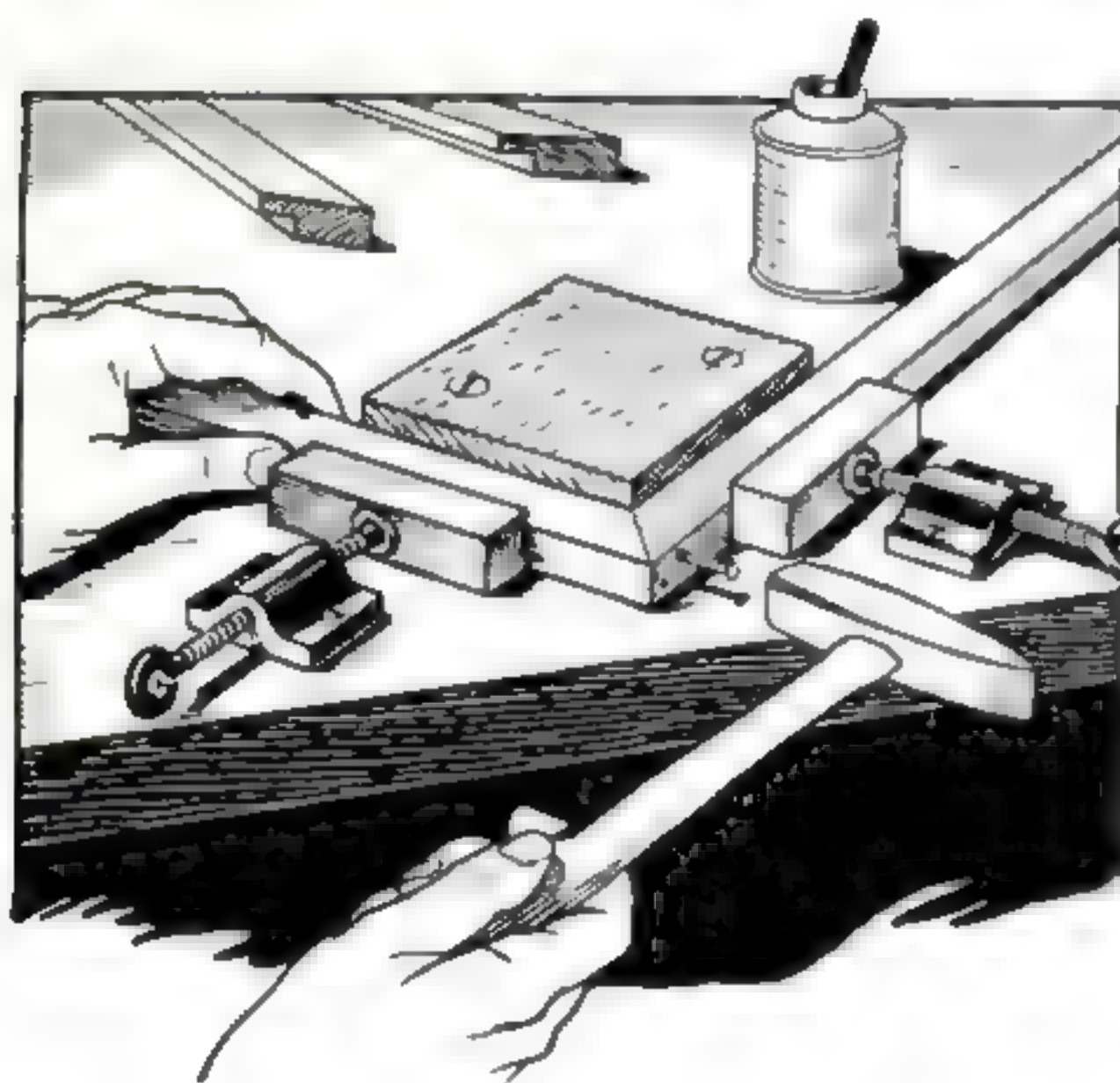
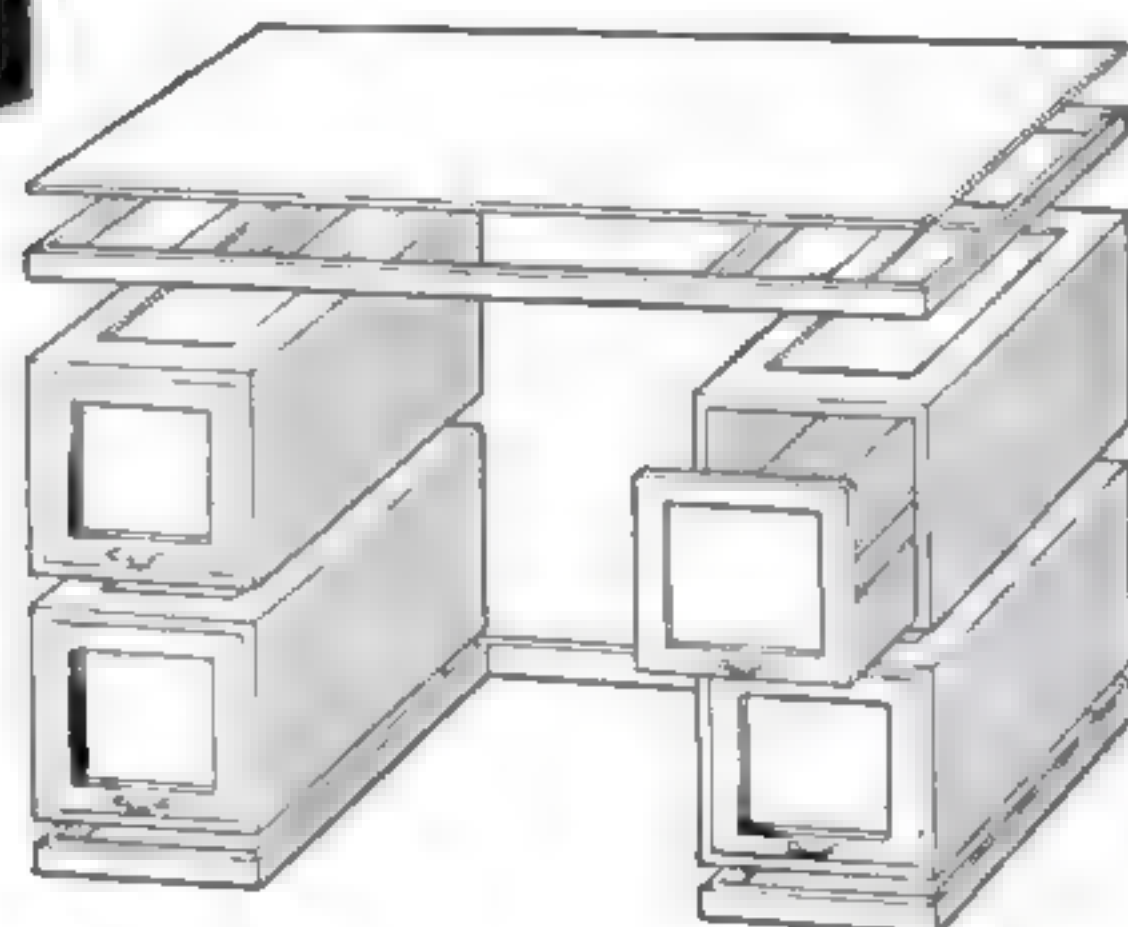
Filing Cabinets Support Flat-Top Desk



FOUR single-drawer letter-filing cabinets were used in constructing the desk illustrated. A frame was built to raise the cabinets 2" above the floor, and a second frame was added on top to give another 2" additional height. This brought the desk top, which is a sheet of plywood, to about the standard height of 30". The whole desk was then finished with dark brown enamel.

The filing drawers, which were obtained from a secondhand dealer, are 12½" deep, 14" wide, and 24" long. Thirty lineal feet of 2" wide lumber were required for the frames, and one piece of plywood ¼" by 24" by 54" for the desk top.—JACK ANTHONY.

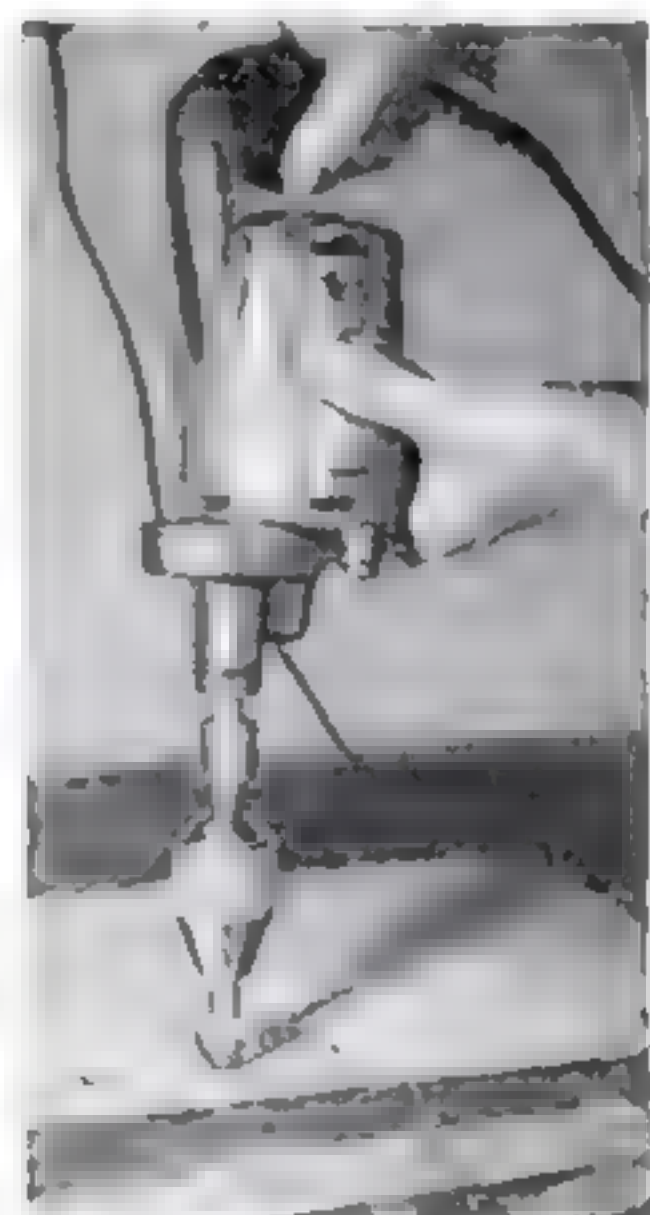
Finished in brown enamel, the desk presents a neat appearance



Construction of desk. The cabinets are held in place with frames

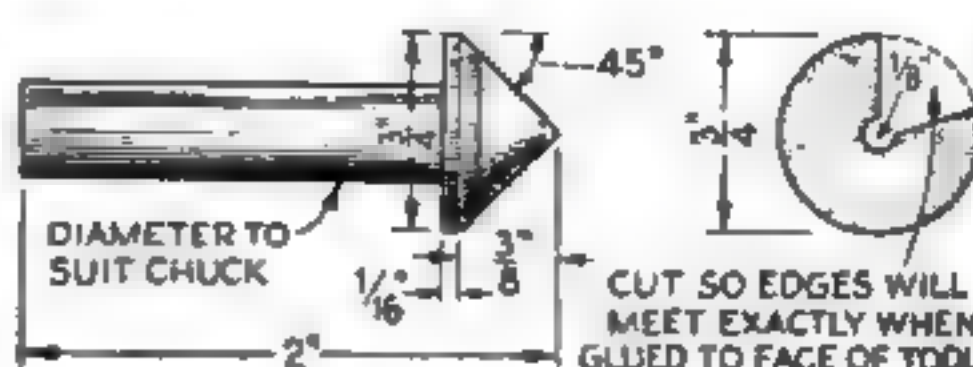
Tool Countersinks Wall Board

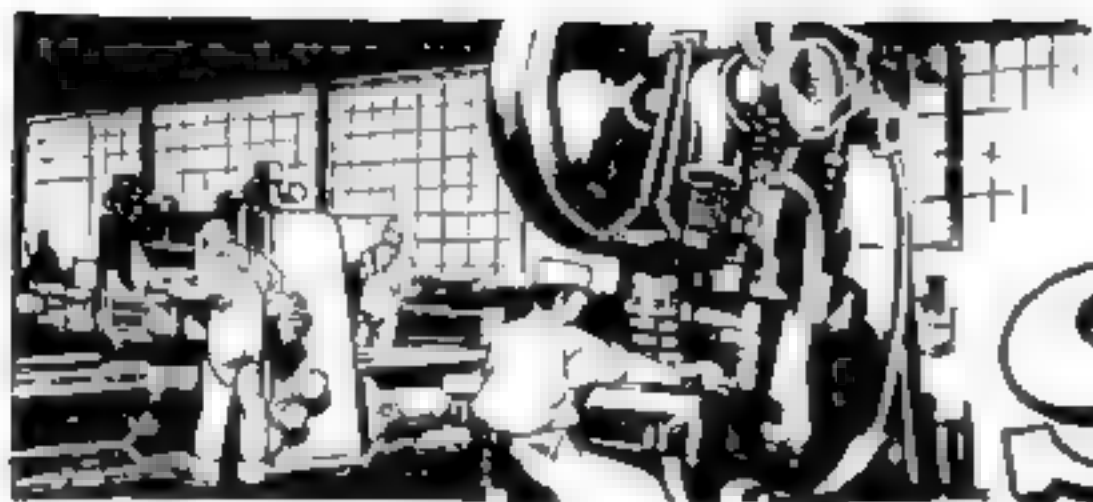
ORDINARY countersinks, when used on fiber wall board, insulating board, or other soft, springy materials, are likely to tear the edges of the holes. A smoother job can be obtained by turning a wooden tool as shown from a ¾" hardwood dowel 2" long and gluing sandpaper on the cone-shaped end. The sandpaper lasts a surprisingly long time, but is easily replaced with a new piece when worn out. The tool will make smooth, clean cuts in any soft, spongy material.—W. C. W.



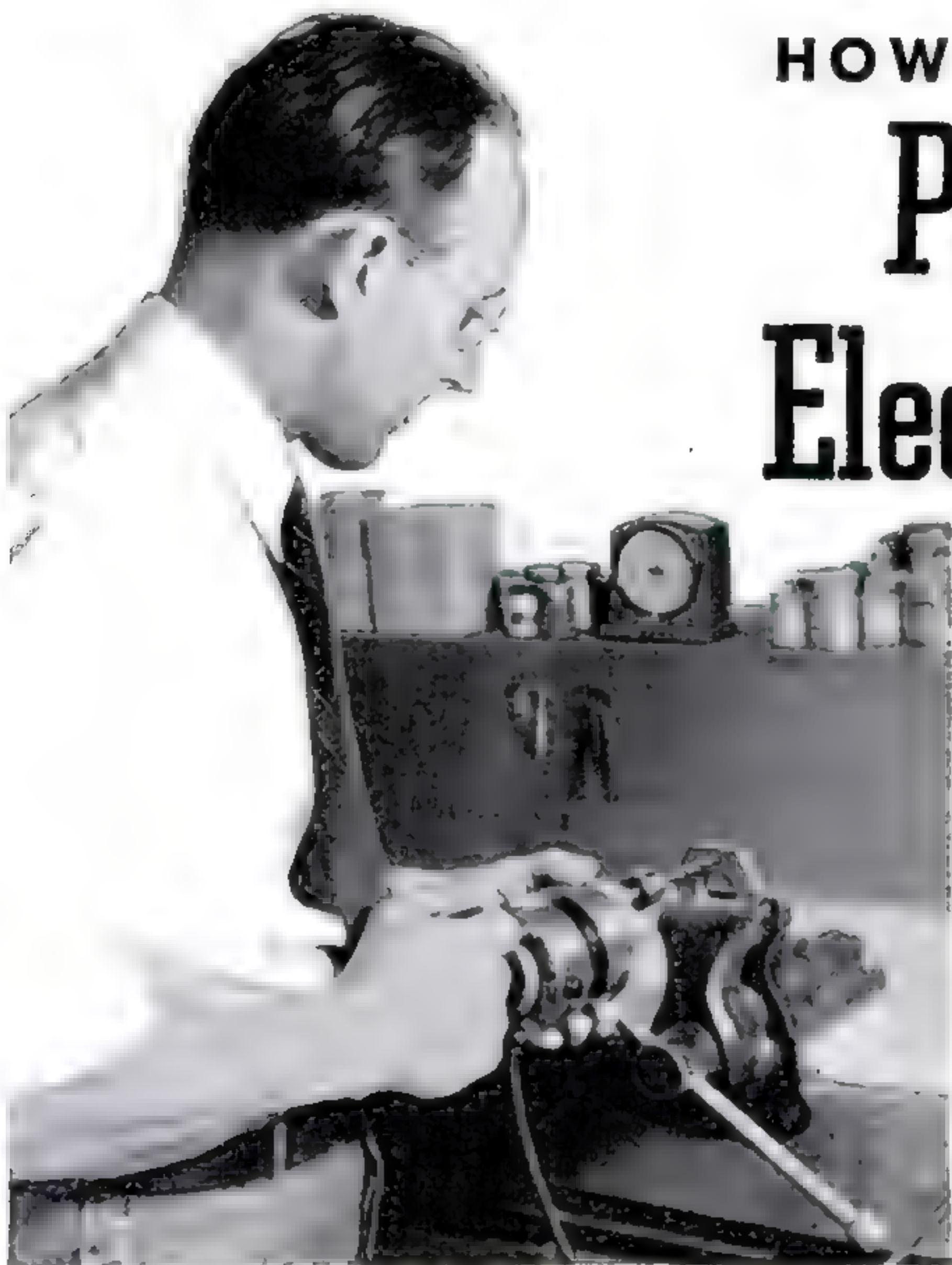
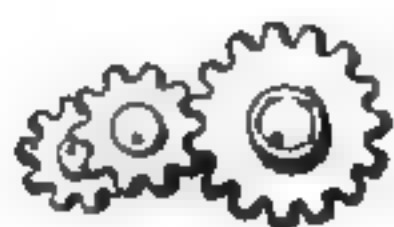
Window Locks Make Useful Clamps and Hold-Downs

SMALL bench-top clamps for gluing picture frames and similar work may be made from ordinary screw-type window locks. They are also sometimes useful as hold-downs on a miter box, in which case they are mounted on the back of the miter box. Pieces of scrap stock should always be inserted between the clamps and the work.





new SHOP IDEAS



HOW TO OVERHAUL Portable Electric Drills

By

HAROLD P. STRAND

Another thing to check is the brushes. See that they have not worn too short and their springs are in good order. If you can get at the commutator, make sure it is clean and has a good contact surface for the brushes. In case none of these items appears to be responsible for the trouble, there is nothing to do but take the drill all apart for overhauling.

The light duty $\frac{1}{4}$ " drill shown in Fig. 1 would not run. As the difficulty was found to be inside, it was opened up by loosening the various nuts with a set of socket wrenches. Pliers should not be used for this purpose because they damage the nuts. It was apparent at a glance that

the difficulty was due to a broken field wire which was soldered to the top brush guide. The end of the wire was bared with a knife and resoldered as in Fig. 2. If it had been too short, it would have been necessary to splice on a short piece of flexible insulated wire.

Accumulated dirt and grease were cleaned from the field core and brush-holding assembly, and these were laid aside. The armature was next given attention. If a "growler" is at hand, test the armature with it; otherwise, use a series lamp for grounds by attaching one test wire to the shaft and the other to the commutator. No light should be

1. After being taken apart and repaired as in Figs. 2, 3, and 4, the drill was reassembled and tested at full capacity

WHEN an electric drill suddenly fails to operate and you are sure that there is power at the outlet, the first check should be made at the plug on the end of the cord. If this is all right, examine the cord over its full length for a soft or damaged spot that might indicate a break. The next point of possible trouble is in the switch, although this is often accessible only when the motor has been taken apart. If it happens, however, that you can remove the switch, inspect it for contacts that do not touch when the switch is closed or that are dirty or burned.

obtained in this test. With a sharp instrument, clean out deposits of carbon from between the commutator segments. Clean the surface with fine sandpaper until it is bright as shown in Fig. 3.

Examine the gears to make sure they are in good condition and test the bearings for excessive wear. Worn gears or bearings should be replaced. Lubricate the bearings and repack the gear housing after washing out the old lubricant as shown in Fig. 4. Put a few drops of light oil on each bearing surface of the shaft to make sure the latter will turn freely when the motor is started.

After the drill has been re-assembled, test it by drilling a hole through a thick piece of iron or steel as in Fig. 1. Use a twist drill of the full rated capacity. Twist drills made of high-speed steel will stand much more tough work than plain carbon-steel drills and they should, as a rule, be used with electric drills, which run at relatively high speed.

The valve grinding tool shown complete in Fig. 10, resembling an electric drill, required first of all that a mess of black grease be cleaned from the gears. The parts

were washed with a small brush in kerosene and wiped dry as in Fig. 5. Care was taken that none of the fluid got into the motor, which was temporarily laid aside.

Since the switch of this tool is located in the handle, a piece of string was pulled in by the wires as they were pulled out, thus making it easy to pull the wires in again through the curved hollow handle. This string can be



2 A field wire soldered to the top brush guide had broken. The end of the wire was bared with a knife and resoldered

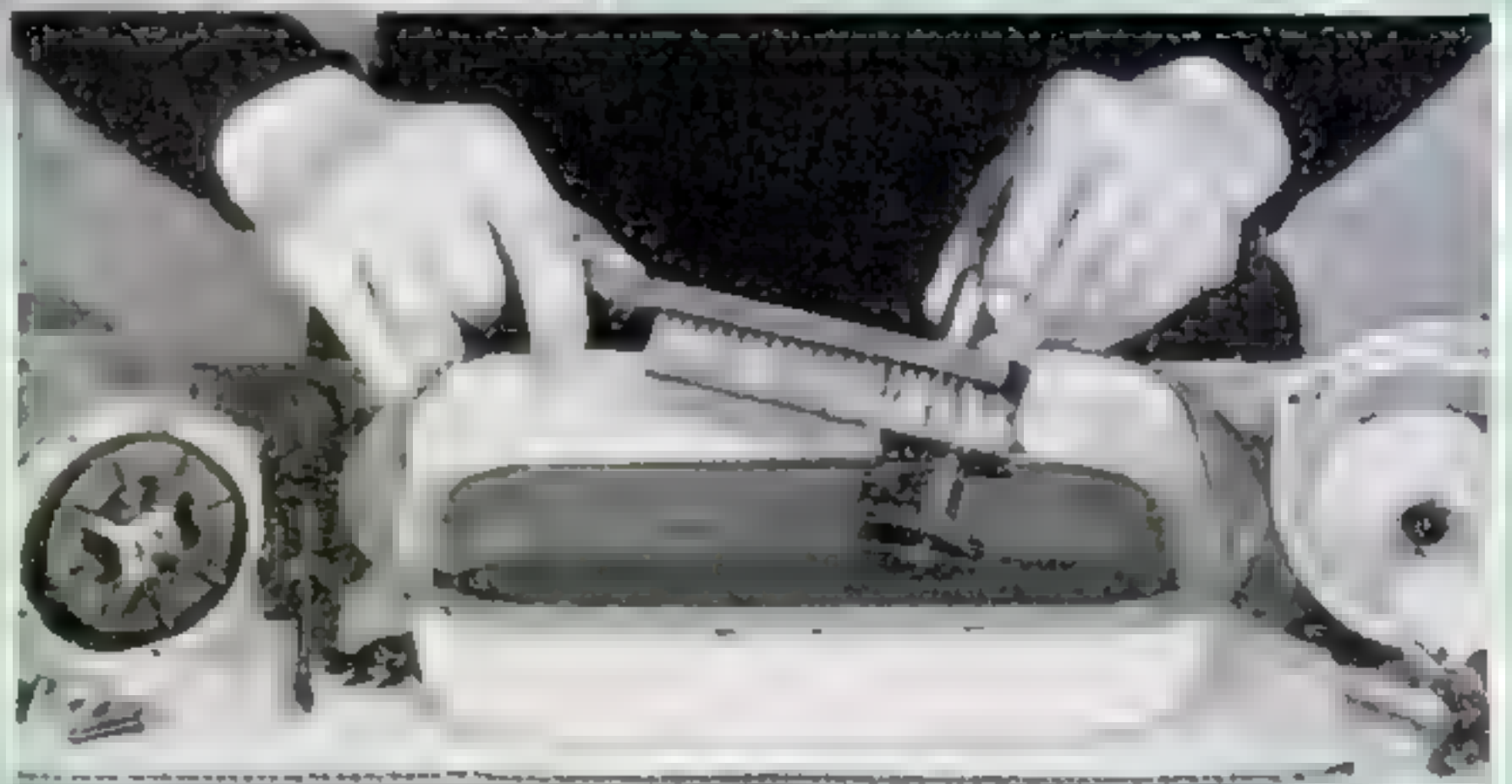


3 Spaces between commutator segments were freed of carbon; then the surface was cleaned with sandpaper



4 Gears and bearings were examined for wear after the old lubricant had been washed out. The gears were then repacked with a medium grease

5 A valve-grinding tool which ran noisily was taken apart as at the right. The motor was set aside while the gears were washed in a pan of kerosene



noticed at the left of Fig. 6.

The cleaned parts were examined for wear. The main shaft bushing was found badly worn and many of the teeth on the gear in the housing shown at the left of Fig. 6 had been almost ground off. A new gear was obtained and installed.

The old bushing was pressed out by using a shoulder arbor in the vise as in Fig. 7. A new bushing was pressed in with the same arbor, but from the other side. In this case, a piece of 1½" pipe about 2" long was used over the long nose of the housing as it was reversed in the vise and allowed to rest against the rear jaw. A short piece of round steel stock was used against the end of the arbor for pressing against with the front jaw.

The new bushing was reamed as shown in Fig. 8. This may be done, if preferred, by clamping the end of the reamer in a



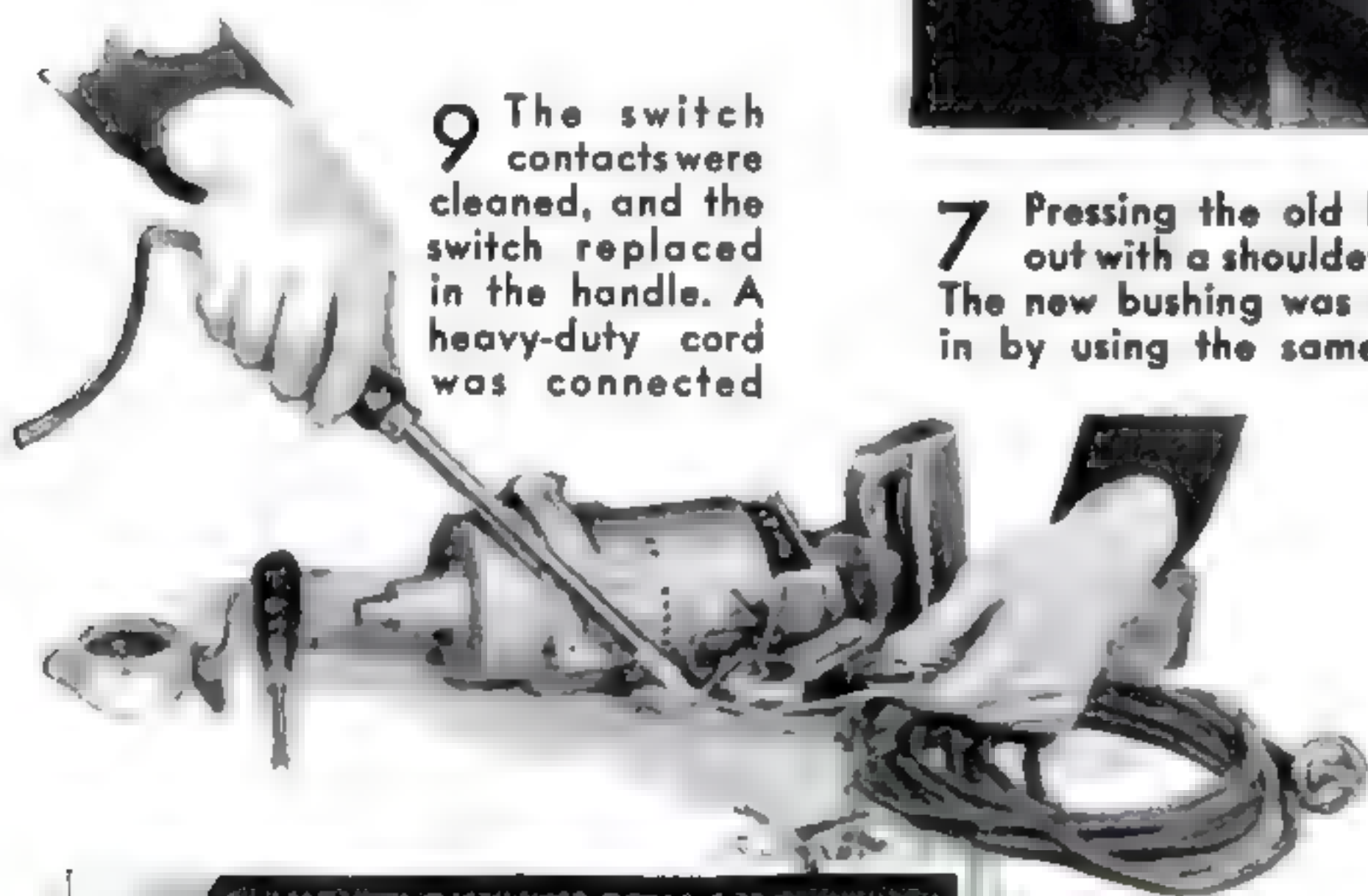
6 The main shaft bushing was found badly worn, and many of the teeth of the gear in the housing at left were bad



7 Pressing the old bushing out with a shoulder arbor. The new bushing was pressed in by using the same arbor



8 As a new bushing is usually compressed slightly when installed, the hole had to be reamed to fit the shaft



9 The switch contacts were cleaned, and the switch replaced in the handle. A heavy-duty cord was connected



10 The handle was refastened and a piece of strap iron bent and drilled to replace a cord clamp, which had been lost

vertical position in the vise and rotating the housing around it.

The remainder of the work was similar to that already described. New brushes were installed. The handle switch was opened up and the contacts cleaned with fine sandpaper. A new cord was obtained, the string used to pull the wires up to the switch position, and the switch connected. The joints at the motor were connected so the switch would be in series with the line and the

motor. They are soldered as in Fig. 9 and protected with both rubber and friction tapes.

In the final assembly it was found that half the cord clamp was missing, so a new piece was formed from strap iron and fastened as in Fig. 10. Several turns of tape were made around the cord under the clamp to guard against abrasion and cause a tighter clamping action.

Handy Countersink Mounted on Top of Drill Press



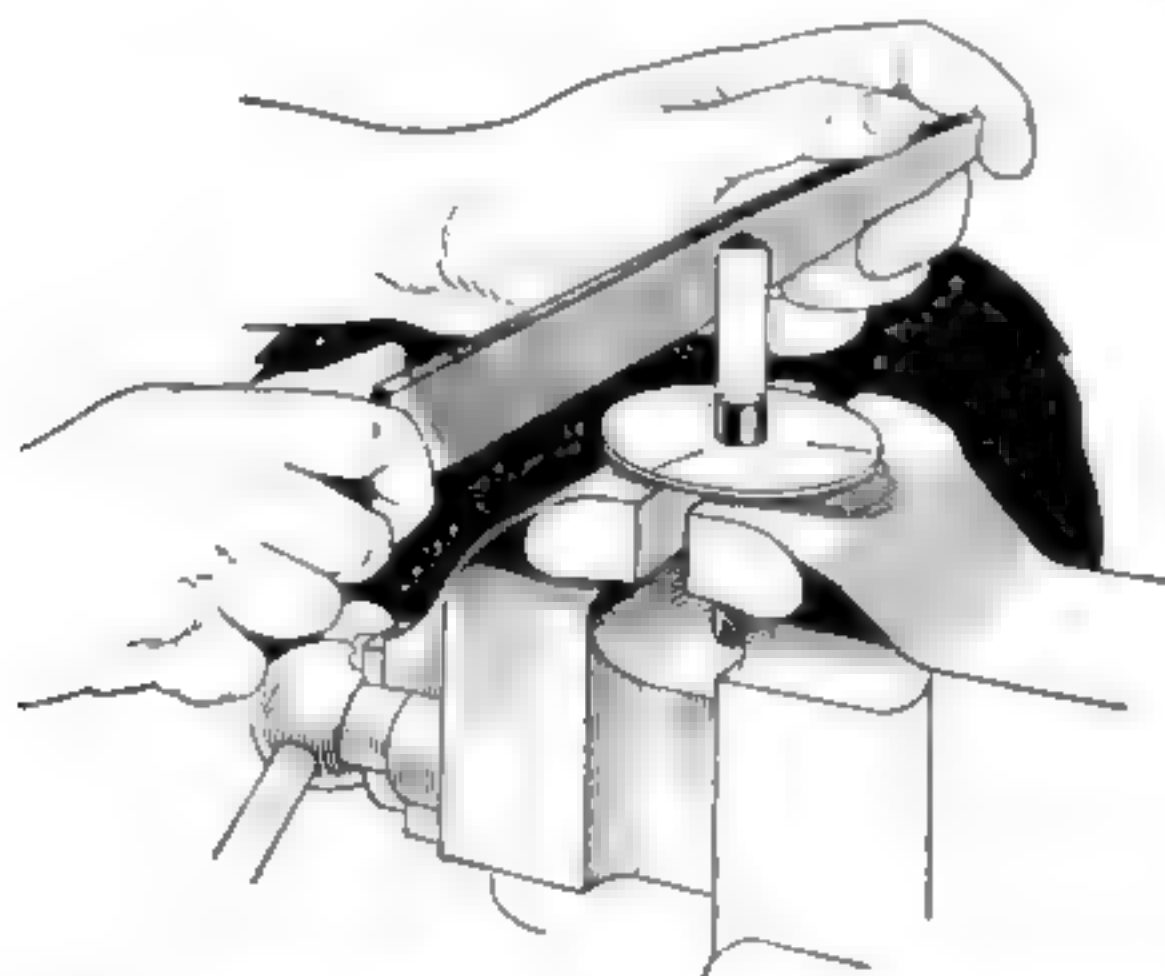
The countersink is always in place, ready for removing the burrs from drilled holes

MANY drill presses have the spindle extending through the bevel gear or driving pulley, and this offers an opportunity to mount a countersink on top of the spindle as illustrated. It saves time in countersinking holes and also in removing the burr. If several holes have to be drilled in a piece, it is important to remove the burr from each in turn or the work will not lie flat.

A piece of high-carbon tool steel is bored to fit the spindle, and the opposite end is turned to a taper of about 82 deg. On this taper are filed or milled four or five cutting edges, which must be left-hand. If a miller is not available, a simple way to make the cutter is to remove half the cone, then cut from the apex to the base and along the base line to the center. This style of counter-

sink works in either direction. Drill and tap for a set screw and harden the countersink.

The set screw can be eliminated, if desired, by boring a slightly tapered hole in the countersink and tapering the end of the spindle so that the countersink can be forced in place. If this is done, the stock need be only $\frac{1}{8}$ " larger in diameter than the spindle.—W. N. LURCOTT.



Easy Way to Close Up Thumb-Tack Holes

DRAWING boards marred as in the left-hand photo can be restored by applying rubbing alcohol liberally and, before it evaporates, going over the surface with a rag dipped in hot water. Rub with the grain until the holes close as in the middle photo. Then sandpaper lightly (right-hand photo).—P. E. W.

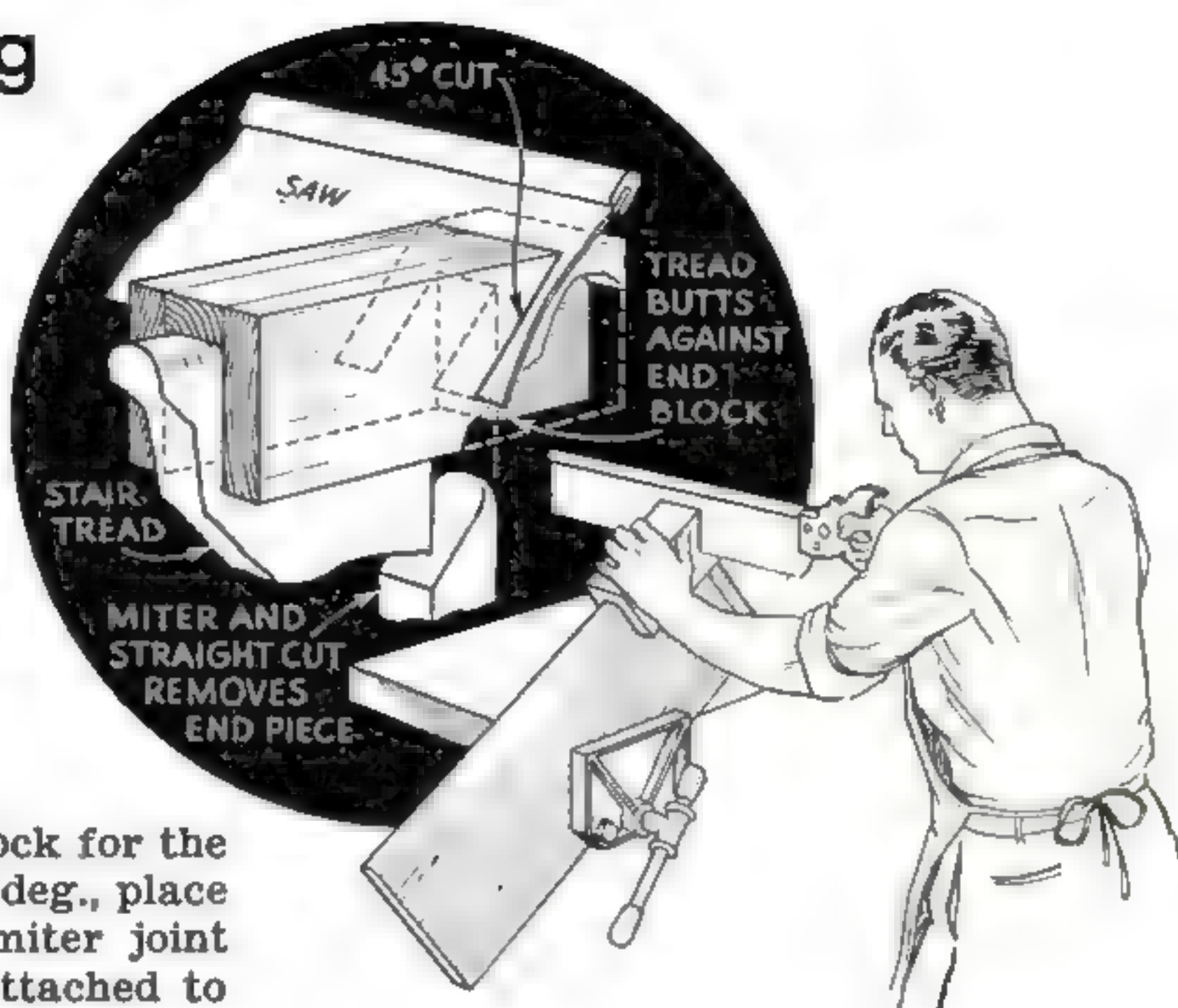
Improvised Index Head Helps in Filing Special Shapes

WHEN any small piece of round stock has to be filed to some special shape, layout marks are practically useless. A good method is to use a sort of index head, which is merely a disk of sheet metal or thick cardboard drilled to slip over the work and marked with the required number of divisions. One mark is registered with the opening of the vise, and the filing operation is performed from that point. The work with the index attached is then rotated until the next mark is lined up. In this way it is comparatively easy to form shaped punches for copper and leather work and for wood carving.—S. G.



A Miter Box for Nosing Ends of Stair Treads

IN THE construction of open-string stairs, one end of each tread must be finished to match the front edge, that is nosed or rounded. It is therefore customary to remove a strip from the end of the tread in such a way that a piece of nosing may be applied. This nosing joins the rounded front edge of the tread with a miter joint. To facilitate making the miter cuts, a jig or miniature miter box may be made as shown. Space the sidepieces just far enough apart to slip over the tread. Hold the stock for the tread in the vise at an angle of about 45 deg., place the jig over it as shown, and cut the miter joint with a back saw. Then the nosing is attached to cover the end grain.—JOHN A. VAN DUSEN.



Cleaning Clogged Lettering Pen

IN ONE drafting room where mechanical lettering guides are used, thirty dollars were saved in a single year by cleaning pens in which the ink had been allowed to dry, and which ordinarily would have been discarded. A small electric erasing machine such as is now commonly used in drafting offices is used. First, a small round hole is cut in the end of an eraser, and the head of the cleaning stem is pressed into this. A few drops of ammonia are placed in the pen, the cleaning stem is inserted, and the motor started. The pen is held between the thumb and forefinger as shown, and pressed very lightly against the stem.—F. W. SPLETTSTOESER.



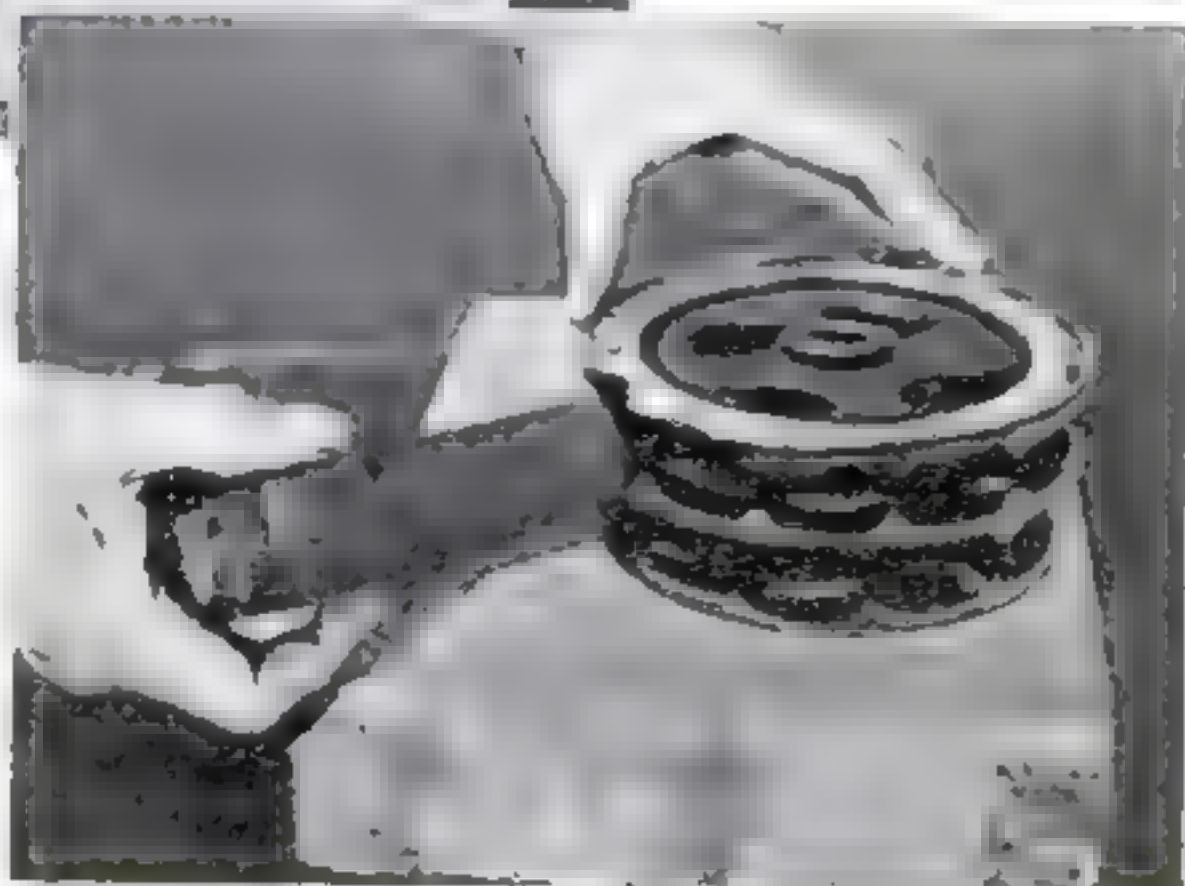
The cleaning stem drills out the ink

Part Broken from a Casting Replaced by Welding

WELDERS are sometimes called upon to repair a casting with a part broken out, such as the chain-block wheel illustrated. The work is prepared for welding in the usual way. Next take a stick of common carbon, like that used in dry batteries, and clean off all the chemicals. Grind or file the carbon to form a sort of mold for the new metal. The weld is started with the oxyacetylene torch in the customary manner, the metal being added to the edges of the broken part and supported by the carbon. This is continued until the weld has filled in the broken place. Some caution must be used in playing the flame on the carbon or the carbon will be burned away in time. On any kind of welding, it is essential that the part being worked be absolutely clean.—W. C. CHENEY.



A stick of carbon is shaped as at the right to serve as a sort of mold so that new metal may be applied with an oxyacetylene torch to fill the break as shown above



How Good Is Your Microscope?

DIATOMS TEST YOUR MAGIC LENSES

IF YOU want to find out how your microscope is performing, try looking at some diatoms through it. If the lenses are working reasonably well, you will be amply repaid, for these tiny, glasslike gems of microscopic plant life are among the most beauti-

ful objects to be found anywhere in nature.

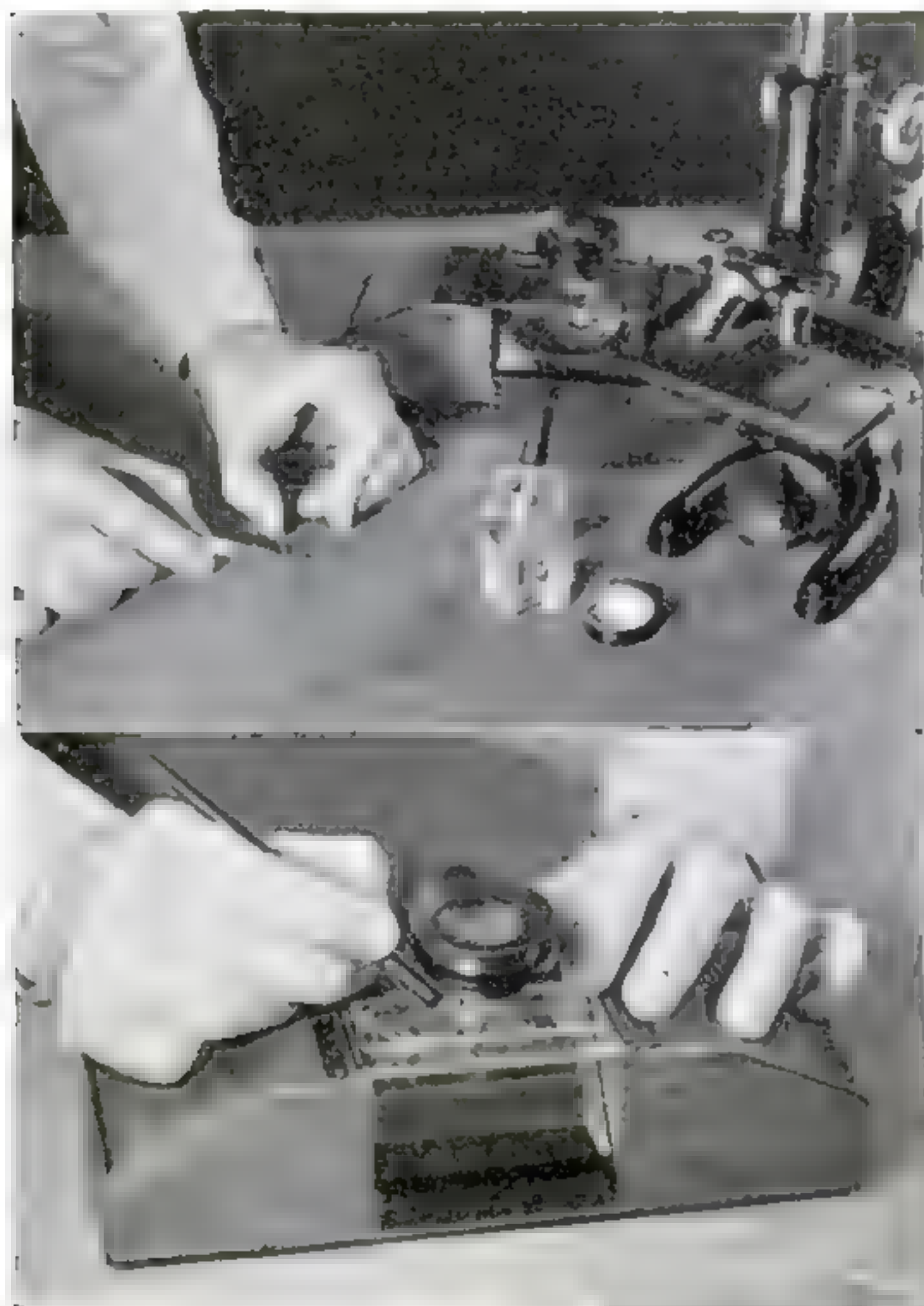
A diatom is a member of the family of tiny, single-celled water plants known as algæ. Diatoms can be found almost anywhere in the world, wherever there is enough moisture to keep them alive; and even in very dry places fossil ones occur. What makes the diatom unusual and highly interesting to the microscopist is its skeleton.

A diatom has the peculiar property of manufacturing an outer covering of glasslike silica. This is one of the marvels of nature, for it consists of two parts or valves which fit together like the halves of a flat pill box; and each valve is marked with delicate and intricate designs made up of dots, holes, lines, and striations. On some of the diatoms, *Pleurosigma angulatum* for instance, the dots measure 50,000 to the inch. If your microscope, at 500 or so diameters, will show these dots clearly, it has lenses that are definitely "good."

The valves of a diatom are not simple products like pieces of glass pressed in a mold to form surface markings, but are of compli-

By

MORTON C. WALLING



SELECTIVE MOUNTING FOR YOUR SPECIMENS

To arrange diatoms in patterns, first spread a film of adhesive on the slide, as in the upper photograph

Then, with a cat-whisker brush, transfer the diatoms to the slide and work them into positions wanted

When a diatom is in place, breathe on the slide. This loosens the adhesive film so the diatom will stick



Collecting diatoms from a garden pool with a dipping tube. The photomicrographs at the left show specimens of various types. Note the wide variety of surface markings



cated construction. Diatoms are small, the biggest being no larger than a period on this page. They are plants, each consisting of a single cell; yet, in some manner that the human mind cannot understand, that cell is able to manufacture glass pill boxes whose beauty and design rival anything a human jeweler is able to produce. Furthermore, the diatom skeletons, though unbelievably small and delicate in structure, are able to persist for thousands of years in the form of fossils or deposits in the earth. Polishing powders and similar commercial articles are manufactured from such age-old diatoms.

In their living form, diatoms are yellowish in color, and often are observed in drops of pond water, swimming about like leisurely submarines. Yes, diatoms can swim, although they are plants. They propel themselves with hairlike cilia extending out from their cells. These cilia, incidentally, are difficult to see even with the best of microscopes

and the most skilled manipulation.

You can find living diatoms in almost any pond or stream. Look for woolly masses clinging to the bases of water plants. These sometimes are made almost entirely of diatoms. The surfaces of stones in lakes and streams often are covered with diatom masses. By carefully dipping thin layers of material from the bottoms of ponds, you can find these interesting plants.

The diatoms in one locality are likely to be totally different from those found in another. Nobody knows how many different forms there are; but they are so numerous that you probably won't be able to study all of them in your lifetime. In addition to the diatoms you find in your vicinity, you can obtain specimens from other parts of the world, through dealers in microscope and biological materials, and perhaps by exchange with other amateur microscopists.

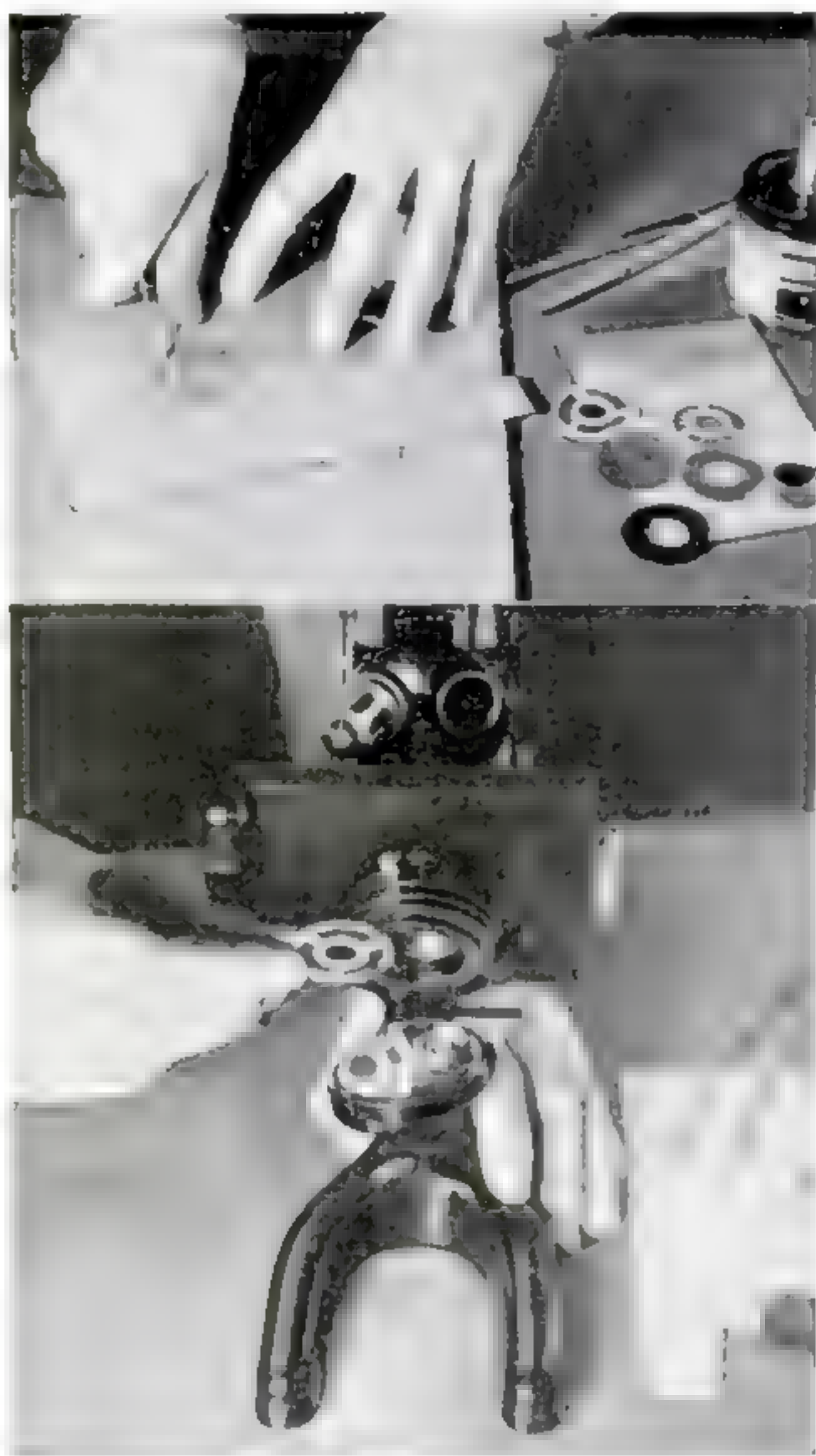
For studying living diatoms, drops of pond water obtained with a dip tube usually will provide specimens. A dip tube is nothing more than a long glass tube. The ends should be fire-polished, to remove the sharpness, by

holding them in a Bunsen flame until the glass becomes soft. To use such a tube, hold your finger tightly over the upper end, lower it into the water until it touches the bottom, and remove the finger. The water rushes in. Hold your finger over the end again, and lift out the column of water.

The silica skeletons of diatoms are commonly the only portions of the plants that interest microscopists, although the living cell is worth studying, too. These skeletons, besides being very beautiful, are highly useful in that they can act as test objects for the microscope, and for the microscopist's skill and patience as well. The dots and lines on certain diatom skeletons are among the finest markings obtainable. Therefore, if a microscope shows them clearly, it is a fairly good proof that the lenses are tops in quality, and that the instrument is being manipulated efficiently. Diatoms commonly used for testing lenses include *Pleurosigma angulatum*,

Amphipleura pellucida and *Actinopterychus heliopelta*. You can buy test slides containing these diatoms. The tests usually consist of determining whether the lens will reveal dots or beads and other secondary markings.

Usually the microscopist wants to mount his diatoms for permanent keeping. There are two ways of arranging them on a slide. One is simply to strew the cleaned skeletons in a layer, so that the individual diatoms do not overlap, yet are numerous enough to provide plenty of material for study. The other way is to mount them selectively, one at a time. You may put only one kind of diatom on a slide, or you may arrange several kinds to form a group. The ultimate in skill is displayed by slides in which various diatoms are arranged to form interesting patterns. Selective mounting is accomplished with the aid of a brush consisting of two or three bristles, or with an instrument made by setting a short length of stiff hair in a handle

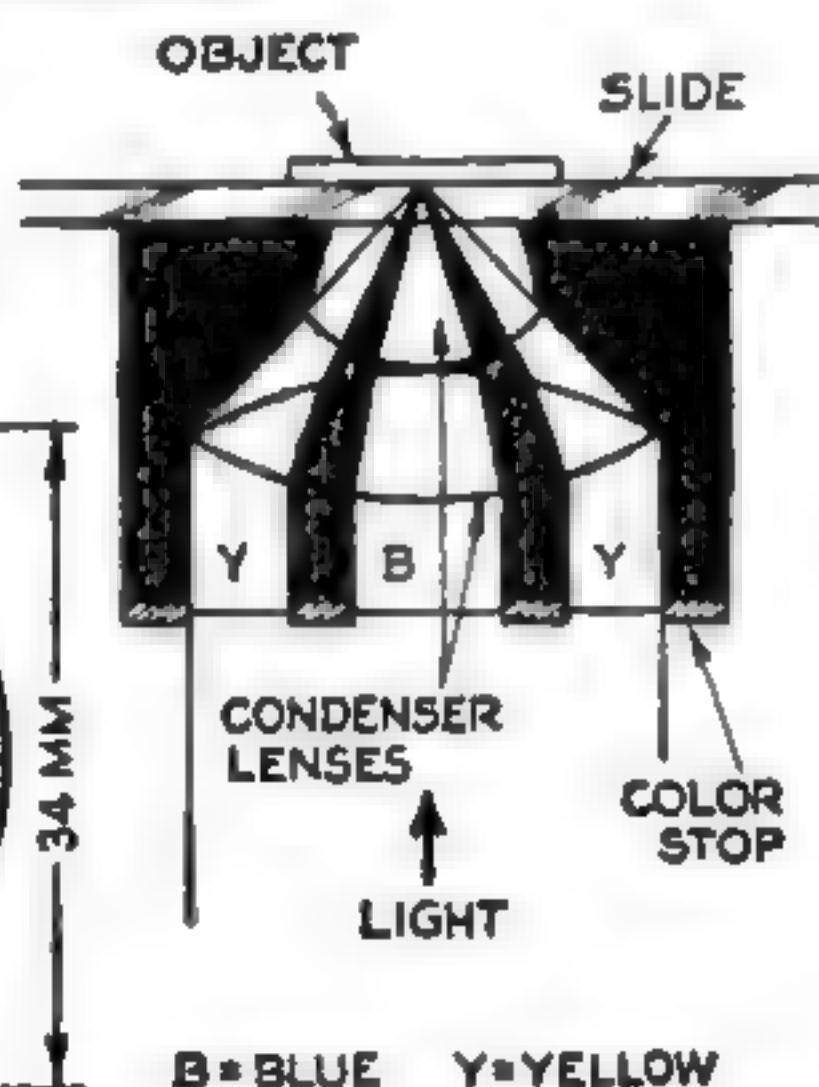
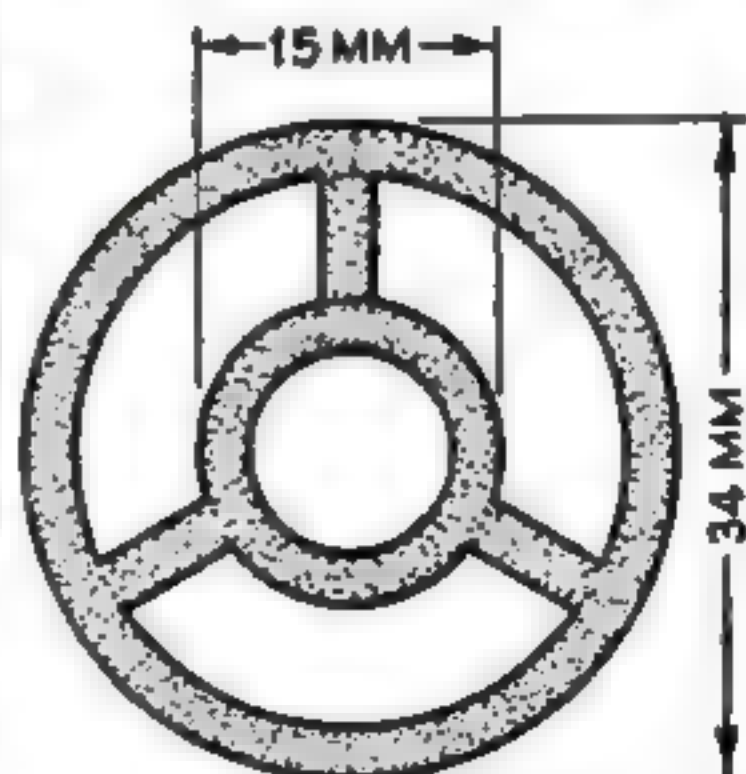


Cutting frames for differential-color filters from thin cardboard. Above, one of the home-made filters is being inserted in a microscope

Homemade Color Stops Give Novel Effects

DIATOMS are particularly beautiful when viewed by differential-color illumination. If your microscope has a substage condenser, you can make color stops to fit below it. Such stops consist of a ring of transparent material of one color, say yellow, with a disk of the same kind of material of a contrasting color, say blue, in the center. Light passing through the ring illuminates the object, while that passing through the center illuminates the field. Thus, with the colors mentioned, a diatom will look like a golden yellow jewel on a field of blue. You can use colored cellulose film for the filters, cementing it between frames cut from thin cardboard, fiber, or heavy paper as illustrated.

Below is the design for frames. Right, how the filter works



like that from a small artist's brush. A cat whisker or a badger hair from a shaving brush will do, although some diatom authorities say the best tool is made by mounting, in a handle, a hair from a pig's eyebrow.

Before diatom skeletons can be mounted for best appearance, they must be cleaned. This is not a difficult process, but is one that must be carried out with care because it involves powerful chemicals. Usually, simple boiling in strong nitric acid to remove organic matter, followed by thorough washing, is enough. The quantity of acid used is small, a test tube having a quarter to a half inch of acid in it being enough. In handling such acid, a well-ventilated room or the outdoors is necessary. Never inhale the fumes, or let the acid touch your skin or clothes. And never pour water into the tube of acid: always pour the acid out into water to dilute it.

Washing diatoms is in itself an important step. Fill the test tube with water, preferably distilled, and let it stand for about three hours. Carefully pour off the water, leaving the diatoms in a mass on the bottom, and add fresh water. Let stand again. Do this three or four times. If there is sand mixed with the glassy skeletons, you can separate it by taking advantage of the fact that sand is heavier, and will sink first. Shake the test tube vigorously when it is half full of water. Then, when the heavier sand grains have settled but the lighter diatoms are still near the top, pour off the water and the diatoms into another test tube. Be sure you have removed all the diatoms before discarding the sand.

Some microscopists treat their cleaned diatoms with a weak solution of formaldehyde to kill mold spores and other organisms that may be present, just before mounting.

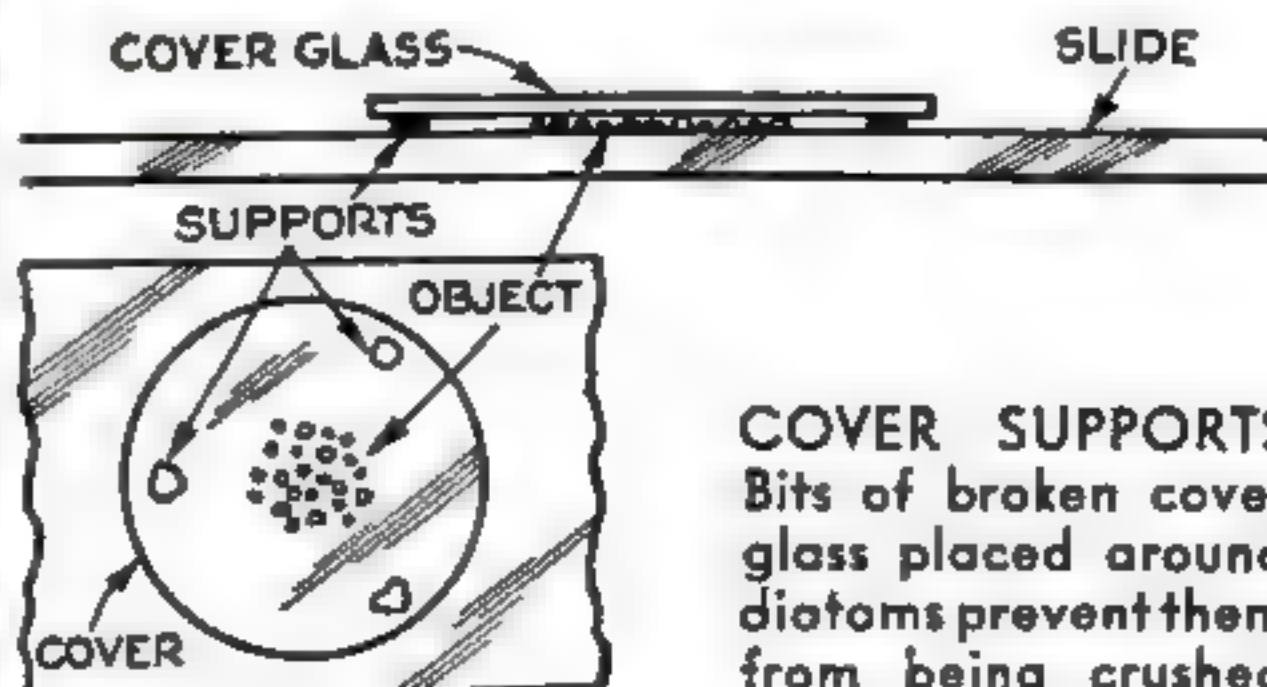


A craftsman at work in a microscope factory. Diatoms like the one pictured above are used to try out lenses

To strew the diatoms evenly, place a perfectly clean cover glass on a level surface and, with a fine-tipped medicine dropper or pipette, let a drop of water containing the specimens fall on the cover glass immediately after you have breathed on the surface to moisten it. The water should spread out instantly, carrying the diatoms out in a uniform layer. To make the cover glass perfectly clean—which is necessary if you want the trick to work—scour it carefully with cleansing powder or clean it with acetic acid. You can keep cleaned glasses stored in acetic acid. Just before using them, wash them with the acid and dry with a [\(Continued on page 236\)](#)



A CAT-WHISKER BRUSH for handling diatoms can be made by setting a badger hair from a shaving brush into a handle. Experts prefer hair from a pig's eyebrow



COVER SUPPORTS
Bits of broken cover glass placed around diatoms prevent them from being crushed

STUNTS FOR THE



Glass Rod Disappears in Mystifying Stunt

A GLASS ROD, a tumbler, and some chlorobenzene, an organic compound which can be purchased in liquid form, will enable you to perform a mystifying trick which illustrates a simple law of optics. Pour the fluid into the tumbler and insert the glass rod. As if by magic, the glass disappears as soon as it enters the liquid. The explanation is that the refractive index of the chlorobenzene is approximately the same as that of glass. Hence, light is refracted through both as though they were one continuous substance.

Test Illustrates a Rule of Air-Conditioning

IF YOU place an empty, tightly stoppered, glass bottle in a refrigerator until it is thoroughly cooled, you will notice drops of moisture on the inside of the glass. Leave the bottle on a table until it regains room temperature and the drops of moisture will disappear. This simple experiment demonstrates a principle vital to air-conditioning; namely, that warm air can hold more moisture than cool air.



When it enters the fluid, the glass rod disappears. Fluid and rod refract light about the same amount

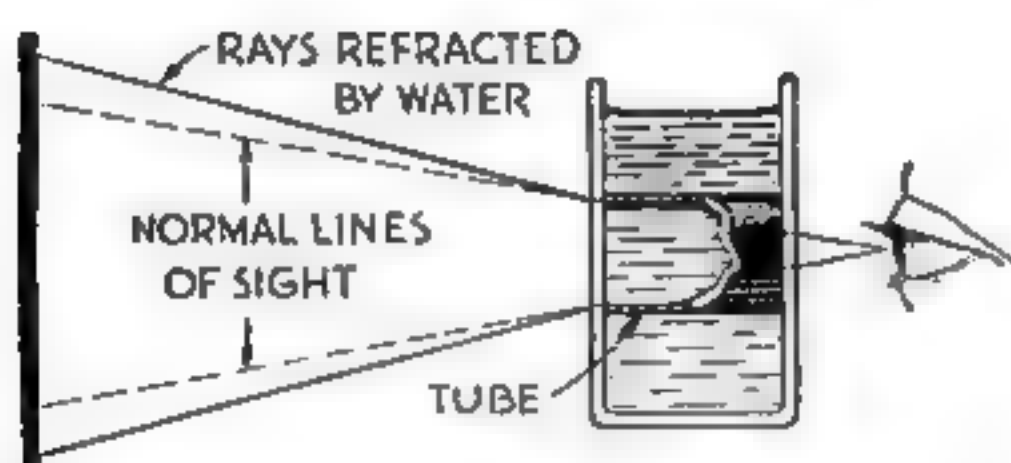


Repulsion varies with the flow of current in the wire

Simple Apparatus Shows How A.C. Meters Work

WIND several turns of door-bell wire around a cardboard tube and attach one end of the wire to a heating unit and the other to an outlet of alternating house current. Then, lower two nails or screws, suspended side by side from threads, into the tube. As they enter the tube, they repel each other violently. The amount of repulsion remains constant as long as the same amount of current flows through the wire. If the current varies, the repulsion varies accordingly. Upon this principle is based the design of a common type of alternating-current electric meter.

HOME SCIENTIST



You Can See More Through Water Than Through Air

How water provides a natural "wide-angle lens" under certain conditions can be demonstrated by an easy experiment. Place a cardboard tube inside a flat-sided glass vessel, as shown in the photograph. Look through the tube and note the boundaries of what you see. Then fill the vessel and look again. Note how much greater an area your vision covers. The difference is due to the fact that water has greater refracting, or light-ray-bending, power than air, and brings in rays from beyond the angle of direct vision in the same manner as the wide-angle lens of a camera.



When the jar containing the viewing tube is filled with water, you have a wider field of vision than when you merely look through air

How Sea Shells Get Their Colors

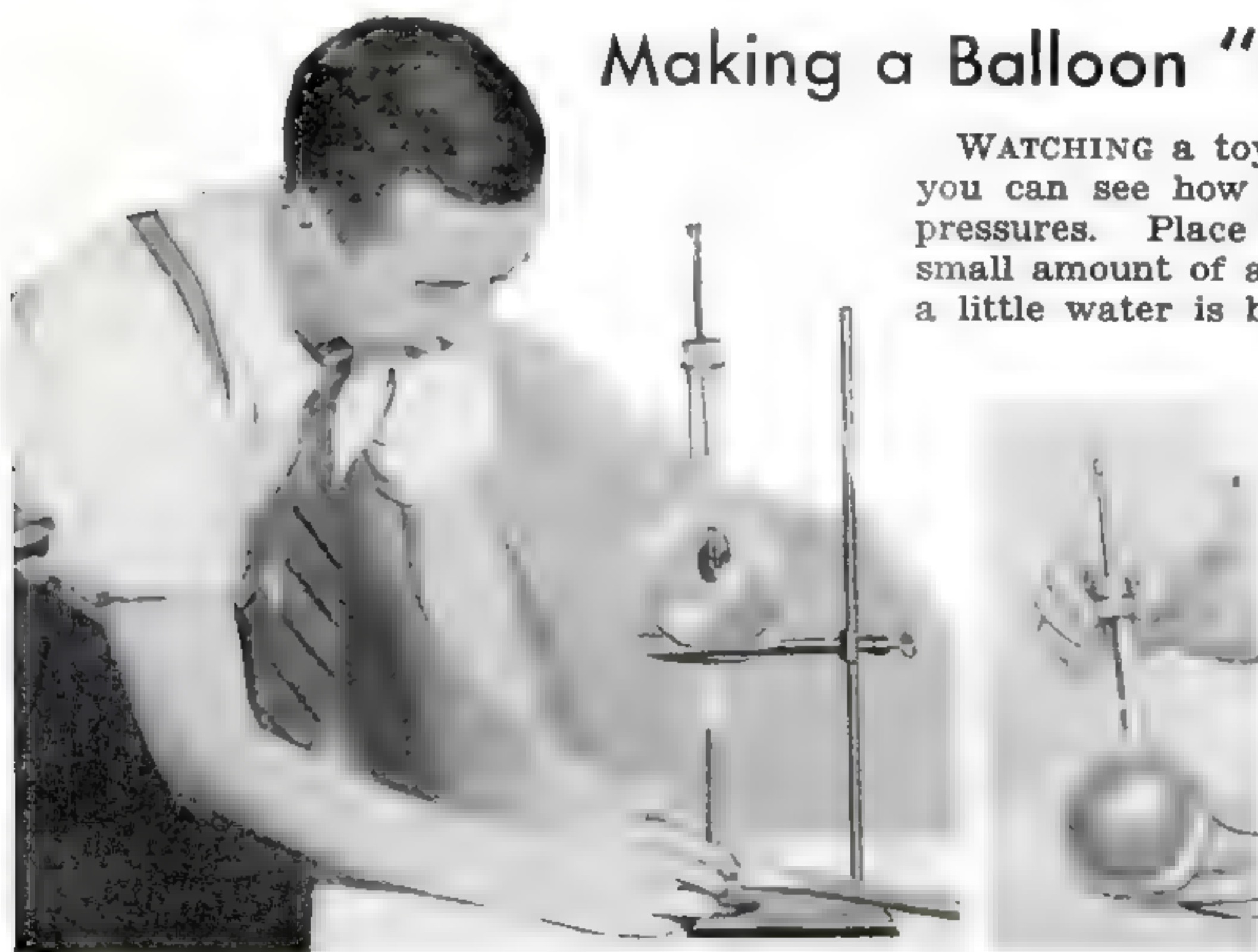
THE beautiful iridescent hues in the mother-of-pearl lining of sea shells are not due to pigment but to microscopic grooves which cause light striking them to be diffracted into rainbow tints. To prove this, press soft white wax onto the shell. When the wax is removed and held in the light, colors appear on its surface.



Making a Balloon "Blow Itself Up"

WATCHING a toy balloon "blow itself up," you can see how gases expand to equalize pressures. Place the balloon, containing a small amount of air, inside a flask in which a little water is boiling over a flame. The

balloon is attached to a stopper which turns the flask into an air-tight container. Immediately remove the heat and allow the flask to cool, and the balloon will begin to expand. The water vapor inside the flask condenses, producing a partial vacuum, and the air within the balloon continues to expand until the pressure inside and the pressure outside the balloon become equalized.



As the flask cools, producing a partial vacuum, the air in the balloon expands

NATURE: Master Chemist

HOME TESTS SHOW MAGIC OF PLANT GROWTH

NATURE operates the world's greatest chemical industry. Every blade of grass, every green leaf on a tree, is one of her laboratories. Through some secret process of her own, they transform carbon dioxide from the air, and water from the soil, into sugars, starches, oils, and cellulose. Chemists are only beginning to understand how the feat is done. The key to the process seems to be chlorophyll, the green pigment

that nature employs as a catalyst, or chemical go-between to put the raw materials together.

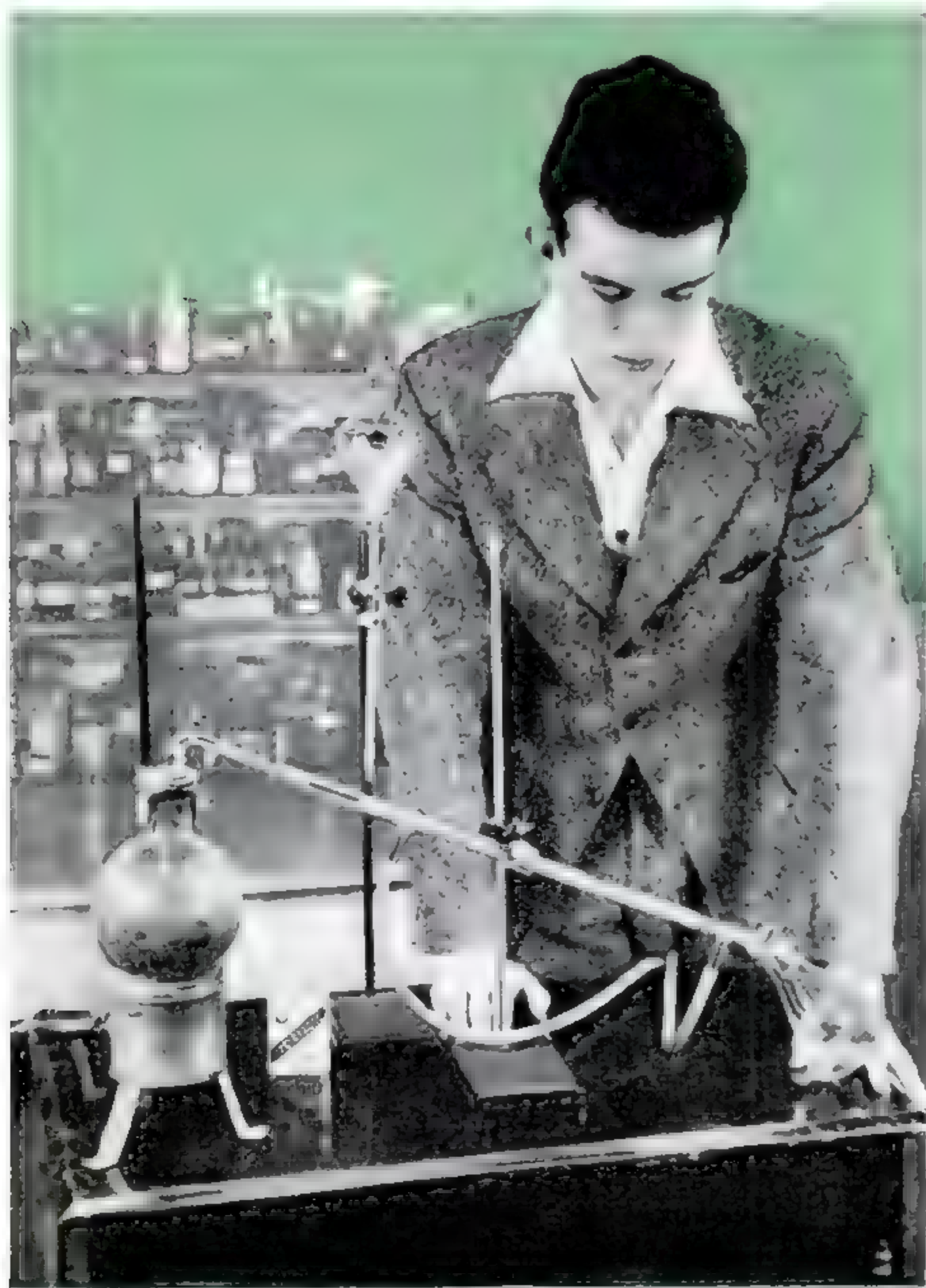
You will enjoy experimenting with some of the living things that you can find in your garden, or obtain on a trip through fields and woods. From tree leaves or grass, for example, you can extract and analyze the chlorophyll that plays such a vital role in these living chemical factories.

Suppose you start by taking four or five green leaves about as large as your hand, from a tree. Grind them in a mortar with some sand and several fluid ounces of a suitable solvent, such as grain or denatured alcohol. Other solvents that may be substituted include acetone, benzol, carbon disulphide, and the "safe" dry-cleaning fluids. The sand helps to macerate the leaves and expose the inner cells to the action of the solvent.

After several minutes of grinding, filter the solution through ordinary filter paper. It will be clear and dark-green in color, when the light shines through it. The surface of the solution, viewed by the light that it reflects, will appear yellowish red.

Your sample is a "crude" extract of chlorophyll, containing four principal ingredients. Two of them, known to chemists as chlorophyll A and chlorophyll B, are responsible for the green color. An orange-red pigment called carotin and a yellow pigment, xanthophyll, are present in smaller amounts. Though their colors are masked, you can detect these compounds by a simple test.

Let some of the green-colored alcoholic extract of chlorophyll drip slowly upon a piece of clean white blotting paper. The drops should fall at just the same spot,



Distilling oil of cloves from powdered cloves obtained at the grocery store. The same set-up, using a water-cooled condenser and a homemade electric heater, will distill other essential oils

Your flower and vegetable garden will yield many of the necessary materials for performing interesting experiments to reveal the magic of nature's own chemical laboratories



and at about five-second intervals, for a minute or more. A circular stain will spread to about two inches in diameter. You'll find the spot green in the center, where the chlorophyll pigments impart their color. The fringed edge of the circle will be colored reddish yellow, however, by the combined effect of the carotin and xanthophyll. In this test, the blotting paper acts as a sort of filter, "adsorbing" or holding back more of the

chlorophyll than of the other two pigments.

Another way to perform this experiment is to fill a glass tube, about half an inch in diameter and six to eight inches long, with precipitated chalk. Close the lower end of the tube with a one-hole stopper carrying a piece of glass tubing. Pour the crude chlorophyll extract upon the top of the chalk and let it filter through. The upper part of the chalk adsorbs the chlorophyll and will be

colored green. Other compounds will remain in the liquid that drains out at the bottom, coloring it yellow. This variation of the test, using the column of chalk, works best when the crude extract of chlorophyll has been made with benzol or with a safe dry-cleaning fluid (refined kerosene).

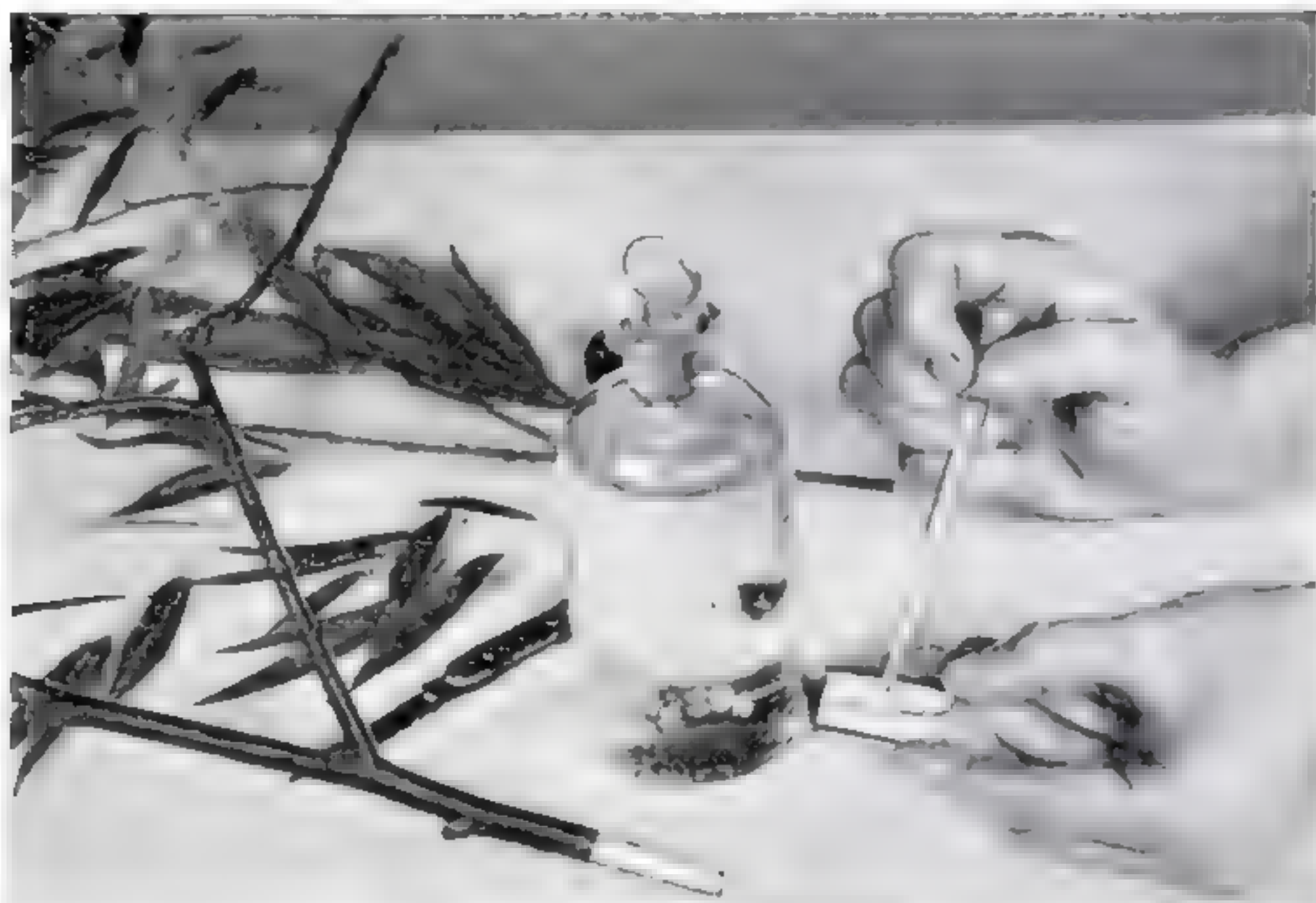
Delving deeper into the make-up of chlorophyll, you will discover it to be a "metallo-organic" compound. Besides the common ingredients of organic chemicals, it contains a metallic element, magnesium.

To confirm this odd fact, about a fluid ounce of the dark-green, filtered alcoholic extract of chlorophyll should

By RAYMOND B. WAILES



A drop of iodine on a cut potato produces a spot of blue indicating the presence of starch. On a dahlia bulb, iodine has no such effect



Apply a drop of strong sulphuric acid to the inner bark of a willow branch and red flecks will appear, indicating solicin, another of nature's products

be concentrated to a volume of only a few cubic centimeters—a teaspoonful or so. The gentle heat required to do this, without loss by boiling and spattering, can be supplied by a hot-water bath or by the homemade electric lamp-bulb heater described in an earlier article of this series (P. S. M., Aug. '39, p. 182). Pour the concentrated solution into a porcelain crucible or evaporating dish, and heat the vessel to redness. This will burn off the organic part of the chlorophyll, leaving the magnesium behind in the form of a white ash of magnesium oxide. Scant as the amount of ash will be, it is enough for the presence of magnesium to be detected by a chemical test.

To the ash add several drops of dilute hydrochloric acid or sulphuric acid. Warm gently, and dilute with an equal volume of water. This converts the insoluble magnesium oxide into soluble magnesium chloride or magnesium sulphate. Now make the solution neutral or very faintly alkaline, with a solution of potassium hydroxide or sodium hydroxide, using litmus paper as an indicator.

For a test reagent, dissolve a crystal of iodine, and twice its volume of potassium iodide, in a few cubic centimeters of water. Add a solution of sodium hydroxide or potassium hydroxide, until the brown color of the iodine disappears. This yields a clear, alkaline hypo-iodate solution. Add several cubic centimeters of it to an equal volume of the chlorophyll-ash solution. You will observe a brick-red or brown precipitate, which shows the presence of magnesium. The precipitate consists of magnesium hydroxide, colored brown by free iodine that it adsorbs. This is known as the Schlagdenhauffen test for

detecting magnesium.

An alternative test for magnesium employs a dye called titan yellow, or Clayton yellow. You can obtain it from dealers in the sensitive reagents used for micro-analysis, the "Tom Thumb" branch of chemistry in which delicate tests identify near-microscopic samples. Add half a cubic centimeter (about eight drops) of a water solution of titan yellow to a drop of the chlorophyll-ash solution. Then add a drop of a solution of sodium hydroxide or potassium hydroxide. The red color or precipitate that forms indicates the presence of magnesium.

That a green leaf contains starch can be shown with the familiar starch-iodine test. Rub a green leaf between your fingers for a minute, in ordinary gasoline (*not* colored "anti-knock" gasoline, which should not be handled), and shake off the surplus liquid. Now give the gasoline-soaked leaf a bath in hot alcohol. Heat can safely be applied with the electric lamp-bulb heater referred to in a previous paragraph. This treatment washes out the green chlorophyll, leaving the leaf colorless.

Now wash the leaf in a little water for a second or two, to make it less brittle. Touch the surface of the leaf with tincture of iodine, or, better, iodine dissolved in gasoline. A blue color indicates the presence of starch.

Just how the leaves make starches and sugars from carbon dioxide and water, with the aid of chlorophyll, remains a mystery. Some chemists suspect that the chlorophyll induces a reaction between carbon dioxide and water to form formaldehyde; and that several molecules of formaldehyde then "condense" or unite to form a molecule of starch or sugar.

SOMETIMES the starch manufactured in the leaves is sent to other parts of the plant and stored there. For instance, the potato, which grows underground, is full of starch. Apply a drop of tincture of iodine to the inner surface of a cut potato, and a blue spot, indicating the presence of starch, will be formed. Don't be misled, however, into thinking that all underground tubers contain starch. Though a sliced dahlia root resembles a cut potato, a drop of iodine applied to it produces no blue coloration. Instead of starch, the dahlia tuber will be found to

contain a carbohydrate that is called inulin. Your garden, or adjoining woods or fields, will yield other materials for your chemical experiments. It is easy to distill the "essential" or volatile oils from many of the fragrant plants that grow about you. For this purpose, you will need running water in your home laboratory, as the condenser of your distilling apparatus must be water-cooled.

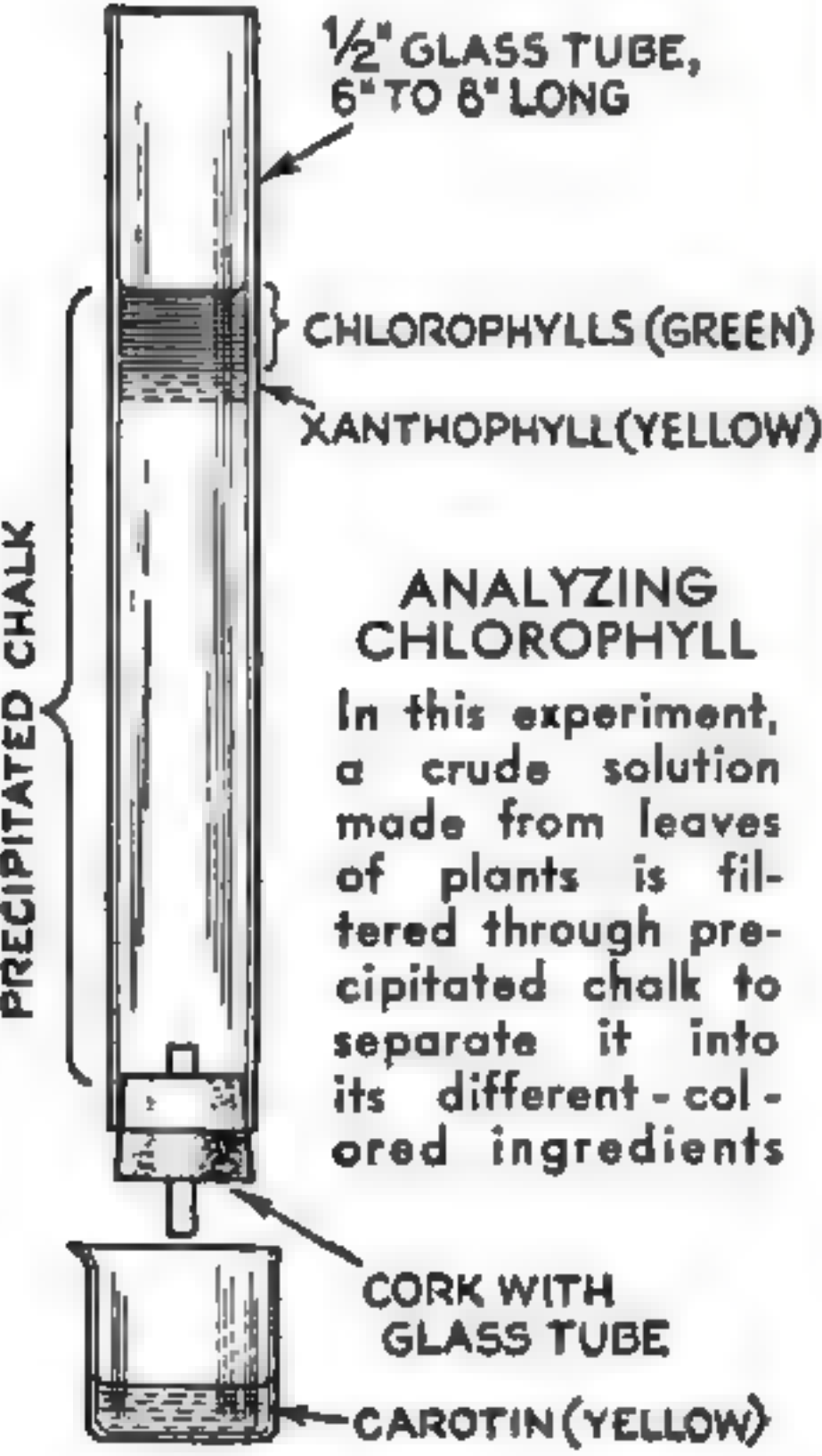
Half fill a round-bottomed flask with the material to be distilled, which may be chopped-up plants such as pennyroyal, spearmint, and peppermint; bergamot or lavender flowers; pine needles; or wood from an old pine stump. Then add water until the distilling flask is nearly full. Using a V-shaped piece of glass tubing, connect the flask to a water-cooled condenser with a straight inner tube of at least quarter-inch diameter. Corks should be used in making connections.

Start the distillation with a low flame, which may presently be raised so that about a drop of distillate comes over each second. Almost any type of heater may be employed, except an alcohol lamp, which will not give enough heat. Catch the distillate, which will be mainly water, with a little of the volatile oil floating on top of it, in a flask. When distillation is complete (it may be continued until only one fifth to one fourth of the liquid contents remain in the distilling flask), sep-

arate the oil from the water by pouring the mixture into a separatory and drawing off the bottom layer of water with the stop-cock.

You can use grocery-store spices in this experiment, instead of plant material, with considerable success. Cloves, either whole buds or ground, will yield quite a bit of water-white oil of cloves when you distill them with water. If the cloves are ground, apply the heat slowly, letting the water and powder simmer gently for a minute before connecting the flask with the condenser. Entrapped air, until driven from the powder, makes the mixture tend to foam over. Practically all the oils that you distill will float on water. Oil of cloves is an exception; it is heavier than water, and will sink to the bottom.

If you can find a willow tree near your home, strip the [\(Continued on page 234\)](#)



New Wrinkles in



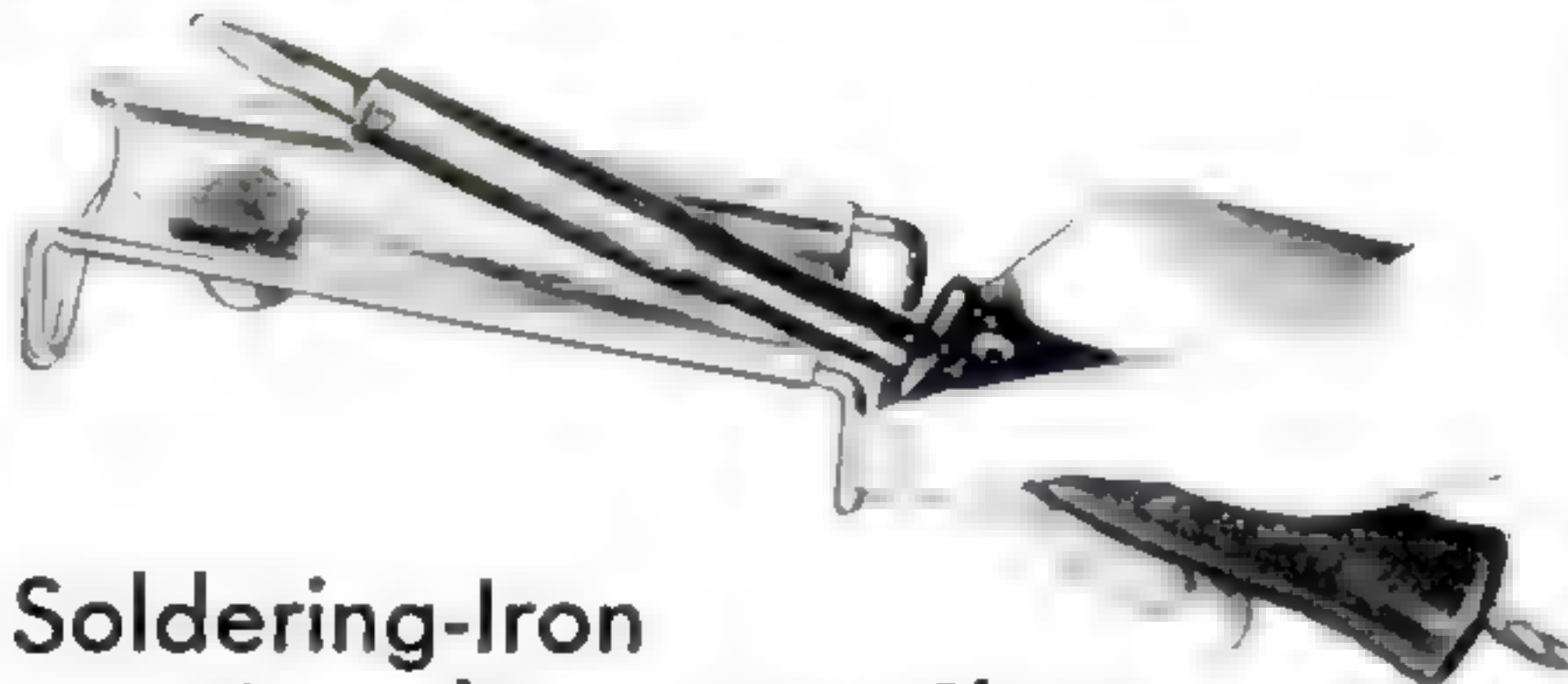
TO LISTEN to radio news broadcasts without disturbing other members of the office force, one New York business man has connected a rebuilt desk telephone to his receiving set. In this way, he can switch on the radio and listen to broadcasts through the telephone receiver as long as he desires. To all appearances, he is engaged in a conversation over the telephone. After trying the arrangement for a year, he reports that such "silent broadcasts" are ideal for busy offices where a regular radio news report would prove distracting.

Insulating Caps for Condenser Terminals

SPECIAL insulating caps are a new feature on transmitting condensers now being marketed for amateurs. Made of hard rubber, these protecting caps fit snugly over the condenser terminals to insulate them completely. The new safety feature eliminates all possibility of the operator making accidental contact with "live" high-voltage parts. The rubber guards may be purchased separately where it is desired to install them on old condensers not fitted with insulating caps.



How the hard-rubber insulators completely cover a high-voltage condenser's terminals



Soldering-Iron Stand Has Tip Cleaner

STEEL WOOL, filling a metal cup near the end of a new soldering-iron stand, is the unique feature of a radio-worker's aid now being manufactured. The steel wool enables the user to keep the tips of the soldering iron free from oxides. By scraping the end of the iron through the steel wool before reusing the iron, the operator can keep it clean at all times and so do more efficient work. Another feature of the new stand is that the metal supports can be removed. By taking off the supports at either end, the user can tilt the stand to one side or the other for maximum convenience in working.

Dual-Purpose Tube Ideal for Remote-Control Circuits

SERVING as a combination high-sensitivity detector and relay, a comparatively new tube, the RK62, is ideal for use in radio remote-control receiver circuits for model airplanes. Doing the work of two tubes and requiring only a single midget 45-volt "B" battery and a 1½-volt flash-light cell for the "A" supply, the dual unit makes it possible to keep the overall receiver weight at a minimum.

the World of Radio

Color-coded leads permit tapping the line cord for any desired resistance as shown on chart



Line-Cord Taps Give Choice of Resistance

BY CONNECTING leads together, and cutting off and taping the unused ones, any resistance value from 22 to 330 ohms may be obtained with a new universal line cord designed especially for servicemen and experimenters. The leads are color-coded to indicate the resistance.

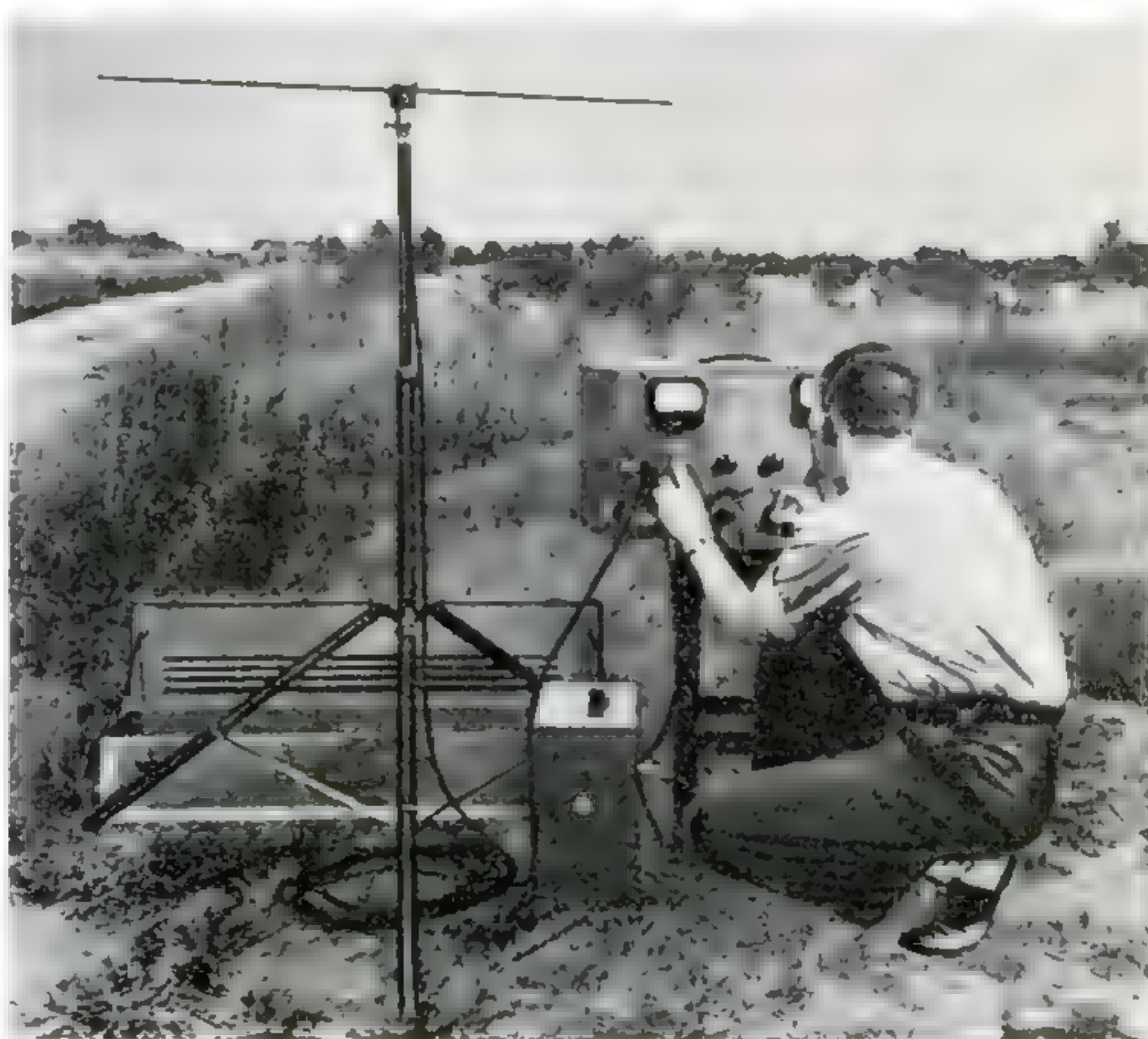
"Camera-Case" Set for Sports Use

WORN like a camera case, and hardly more bulky, a new compact portable radio can be used on hikes and outings where a regular-size receiving set would be out of the question. Its multiturn, non-directional loop aerial is concealed in the shoulder strap. Because the aerial is nondirectional, the little set is said to bring in a wide range of stations. The leather-covered "camera case" in which the midget receiver is housed measures only four by five by eight and a quarter inches. Complete with batteries, the compact receiver weighs less than five pounds.



Portable Television-Signal Tester

FOR surveying the effective range of television and other broadcasting stations operating in the ultrahigh-frequency wave band of from 20 to 125 megacycles, a New Jersey radio-equipment manufacturer has just placed on the market a sensitive, portable signal tester which can be set up quickly and which, when packed, occupies a minimum of space. The new apparatus provides accurate means of gauging the strength of signals of very short wave lengths. And makes it possible to obtain signal records automatically. In addition, the apparatus provides data on the amount of noise which might interfere with effective transmission.



Amateur's Transmitter



HERE IS THE IDEAL
STATION FOR THE
RADIO BEGINNER—
IT IS INEXPENSIVE
AND EASY TO BUILD

PORTABLE and operating on phone as well as key, the all-purpose transmitter illustrated is ideal for the beginner in amateur radio. Easy and relatively inexpensive to build, the crystal-controlled circuit packs unusual power for its size and can be operated on batteries or on regular 110-volt alternating house current. Simply inserting the proper power plug automatically makes the necessary circuit changes for either type of current supply.

With a set of three control crystals—1,975, 7,100, and 14,375 kilocycles—a large proportion of the phone and continuous-wave (key) bands available to amateurs can be worked. Three bands may be covered with either the 160 or 40-meter crystal; while for 10-meter work, a 20-meter crystal doubling in the oscillator output is recommended. Each oscillator coil covers two adjacent bands, one at about 90 and one at about 10 on the oscillator-control dial. As shown in the diagram, a small 2-volt, 60-milliamperere pilot

COIL TABLE					
COIL	TURNS	WINDING SPACE	WIRE SIZE	DIA. OF FORM	TAPS
160-80 OSC.	35	1½"	NO. 24 D. S. C.	1½"	-----
40-20 OSC.	9	1½"	NO. 16 BARE	1½"	-----
160 F	50	2"	NO. 24 D. S. C.	1½"	EVERY 10 T.
80 F	28	2"	NO. 24 D. S. C.	1½"	EVERY 6 T.
40 F	18	2"	NO. 16 BARE	1½"	-----
20 F	10	2"	NO. 16 BARE	1½"	-----
10 F	5¼	1¼"	NO. 16 BARE	1⅛"	-----

Specifications for the plug-in coils. The photograph above shows the arrangement of the control panel

for Phone or Key

By
**HOWARD G.
McENTEE
(W2FHP)**

Operating on either batteries or house current, the compact transmitter can be used at home or in the field. Shown below is the microphone made by mounting a crystal earphone in a cut-down metal flour shaker



lamp is used to protect the crystals by serving as a fuse and current indicator. Should the bulb at any time glow brightly, the power should be turned off immediately and the circuit checked.

In assembling the transmitter follow the photographs closely. Place the various parts as shown. The chassis should be placed 2½" from the bottom edge of the 7" by 7" by 11" standard metal cabinet.

The condenser C_4 must be insulated from the chassis. C_7 , on the other hand, need not be insulated. However, to bring both up to

the same height, I mounted them on small insulators known as "butt-ins." The lead from the microphone jack to the radio-frequency choke, mounted to the right of the socket of tube V_3 , must be shielded. A small tin can cut to size can be used to shield the jack mechanism.

The modulation circuit is designed for use with a crystal or dynamic microphone. A microphone of the so-called "speech-range" type is suitable, but if economy is important an efficient microphone can be improvised by mounting an ordinary crystal earphone in a ten-cent flour shaker which has been cut down to provide a convenient screw-cap case. Black enamel applied to the outside of the case will give the job a professional touch.

With the exception of the 10-meter coil, the coils should be wound on standard composition forms according to the specifications given in the table. The 10-meter coil should be wound on a ceramic form.

The milliammeter is for measuring current

LIST OF PARTS FOR AMATEUR'S TRANSMITTER

T₁.—Output transformer.
T₂.—Power transformer.
Ch.—Filter choke.
R₁.—Resistor, .1 meg., $\frac{1}{2}$ watt.
R₂, R₃₀.—Resistors, 300 ohm, $\frac{1}{2}$ watt.
R₄, R₅.—Resistors, 50 ohm, $\frac{1}{2}$ watt.
R₁₁.—Resistor, 5 meg., $\frac{1}{2}$ watt.
R₁₂.—Resistor, 3,000 ohm, $\frac{1}{2}$ watt.
R₁₃, R₁₄.—Resistors, .25 meg., $\frac{1}{2}$ watt.
R₁₅.—Resistor, 50,000 ohm, $\frac{1}{2}$ watt.
R₁₇.—Resistor, .5 meg., $\frac{1}{2}$ watt.
R₃.—Resistor, 50,000 ohm, 1 watt.
R₆, R₁₉.—Resistors, 20,000 ohm, 1 watt.
R₇.—Wire-wound resistor, 500 ohm, 10 watt.
R₈.—Wire-wound resistor, 30,000 ohm, 10 watt.
R₇.—Wire-wound resistor, 150 ohm, 10 watt.
R₁₈.—Wire-wound resistor, 250 ohm, 10 watt.
R₂₀.—Wire-wound resistor, 50,000 ohm, 20 watt.
R₁₄.—Variable resistor, 5 meg., with switch (**Sw₁**).
 Crystals, 1,975, 7,100, and 14,375 kilocycles.
C₁.—Variable condenser, 200 mmfd.
C₂.—Variable condenser, 140 mmfd.
C₂₁.—Midget condenser, 140 mmfd.
C₁₁, C₁₆.—Electrolytic condensers, 25 mfd., 10 V.
C₁₃.—Electrolytic condenser, 8 mfd., 450 V.
C₁₈.—Electrolytic condenser, 4 mfd., 450 V.

C₃, C₆, C₉, C₁₂, C₁₅, C₂₀.—Paper condensers, .01 mfd.
C₁₇.—Paper condenser, .1 mfd.
C₁₉.—Paper condenser, 2 mfd.
C₁₀, C₇.—Mica condensers, 250 mmfd.
C₅.—Mica condenser, .002 mfd.
C₉, C₁₀, C₁₄.—Mica condensers, 100 mmfd.
 Five 5-prong composition coil forms.
 One 5-prong ceramic coil form.
 Two 2.5-mh. radio-frequency chokes.
 Three 5-prong ceramic sockets.
 One 8-prong ceramic socket.
 One crystal socket.
 Milliammeter, with 100-ma. scale and rear illumination.
Sw₁.—S.P.S.T. toggle switch.
Sw₂, Sw₃.—D.P.D.T. toggle switches.
Miscellaneous.—Tubes, 6V6 (**V₁**), HY60 (**V₂**), 6N7 (**V₃**), 6L6 (**V₄**), 5T4 (**V₅**); four 8-prong composition sockets; two 8-prong composition plugs; shielded mike plug and cable; midget closed-circuit jack; midget open-circuit jack; 60-ma. pilot lamp; line cord and plug; No. 24 DSC wire ($\frac{1}{2}$ lb.); No. 15 bare copper-tinned wire (50'); eight butt-in insulators; three small feed-through insulators; four knobs; two 2" dial plates; cabinet (7" by 7" by 11") with chassis; one crystal earphone (for use as microphone); wire; solder, etc.

either of tube **V₁** or **V₂** by the use of **Sw₂**. It is switched across the 300-ohm resistors, which are so much higher in resistance than the meter that the reading is unaffected.

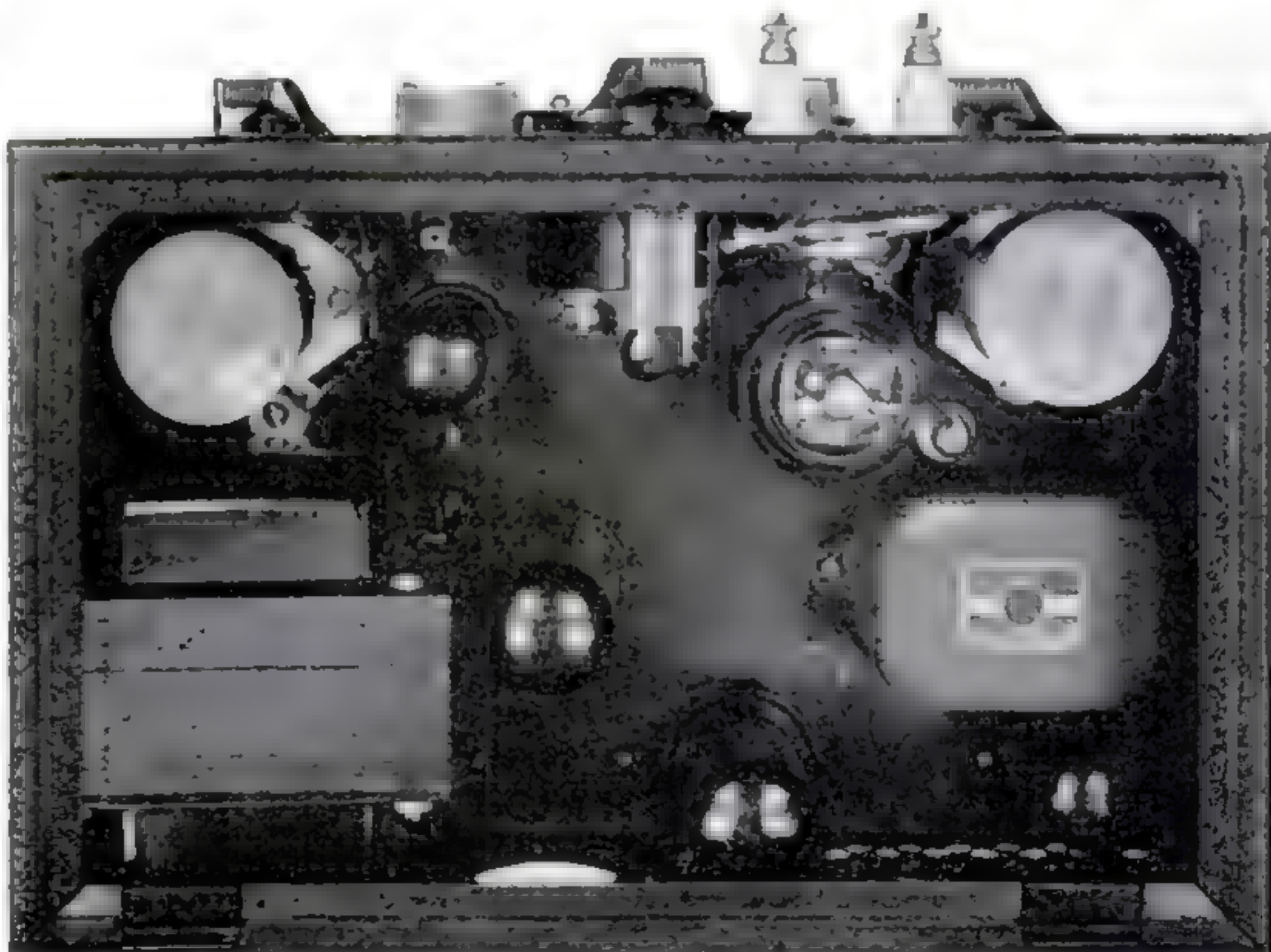
Resistors **R₂** and **R₅** must be of the 10-watt, wire-wound type, as they also act as radio-frequency chokes. **R₇** and **R₁₈** are also wire-wound 10-watters, and **R₂₀** is of 20-watt rating.

It will be noticed that **C₁₉** is an odd value, namely 2 microfarads. This unit must be of the so-called high-voltage type, rated at 475 volts working voltage and 600 volts peak.

The plate current of **V₁** should run about 35 milliamperes or lower when working on the fundamental frequency, and no higher than 40 when

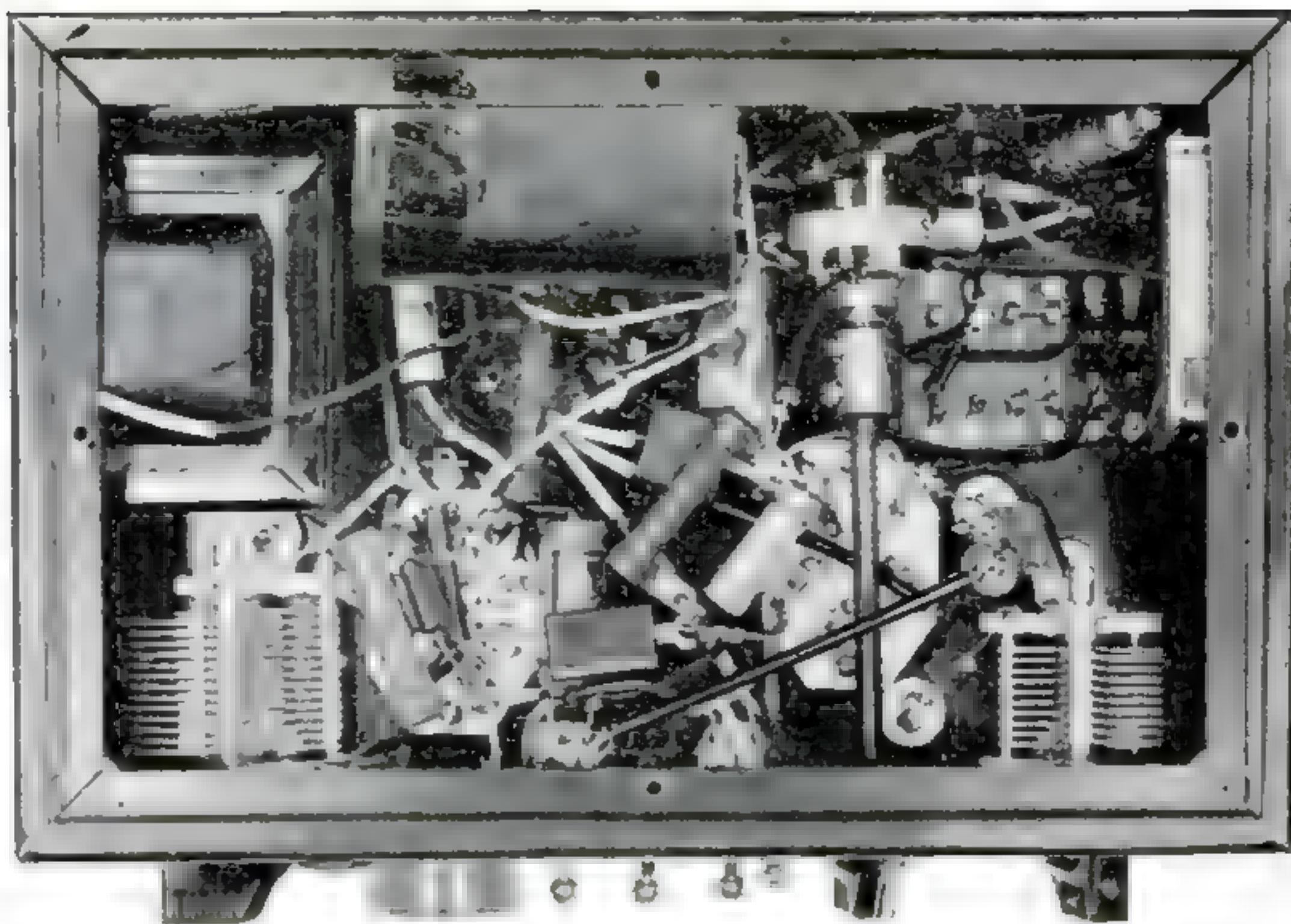
doubling in the oscillator circuit. The current of **V₂** should be around 42 milliamperes on phone, and 55 to 60 on C.W. when loaded.

The cabinet's back and bottom should be drilled with lines of $\frac{1}{4}$ " holes closely spaced. This is important since a great deal of heat is generated. On long runs, it is highly advisable to leave the top of the case open.

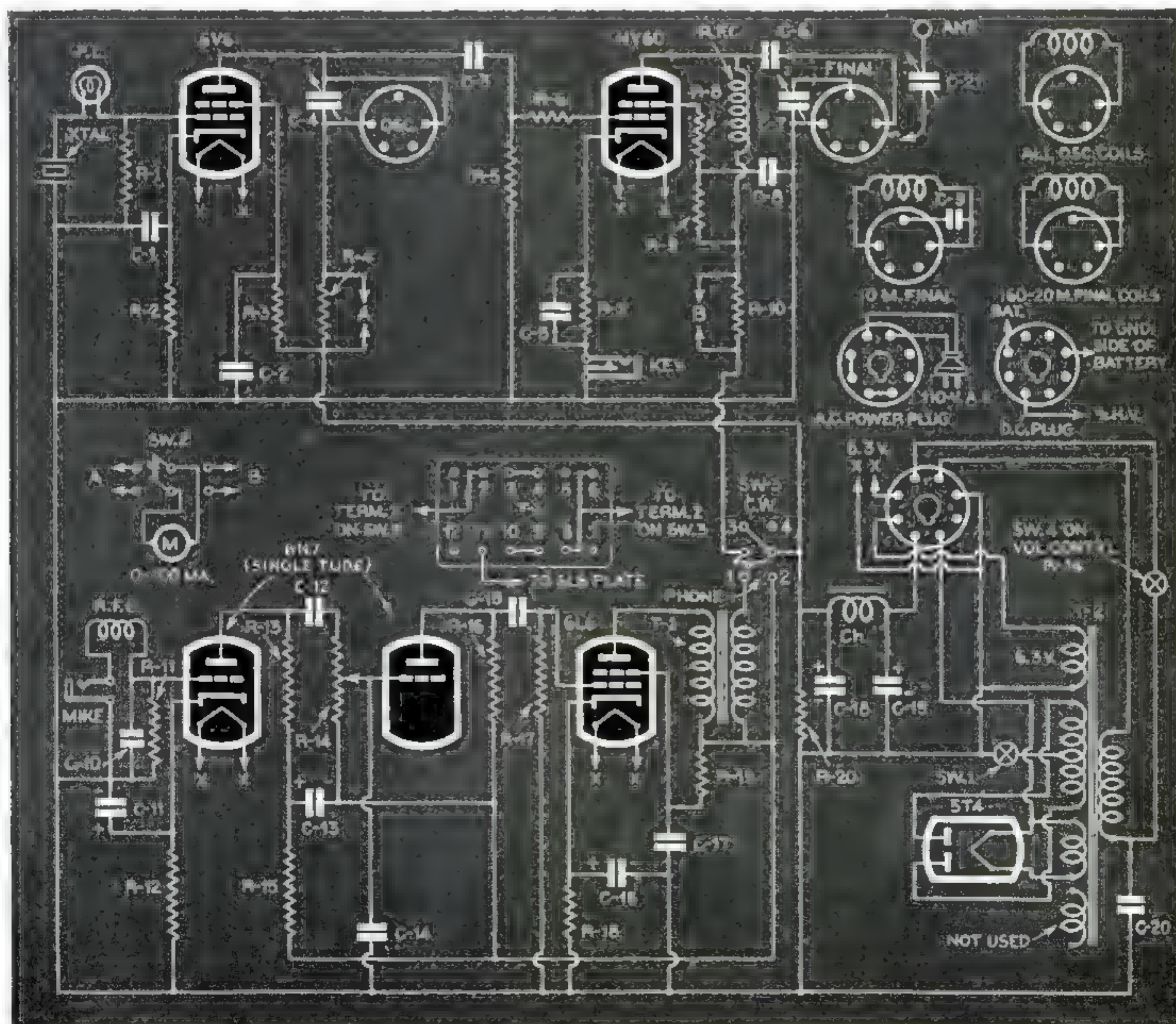


Top view of the transmitter, showing coils, tubes, and other parts. The rear wall of the cabinet should be provided with holes for adequate ventilation

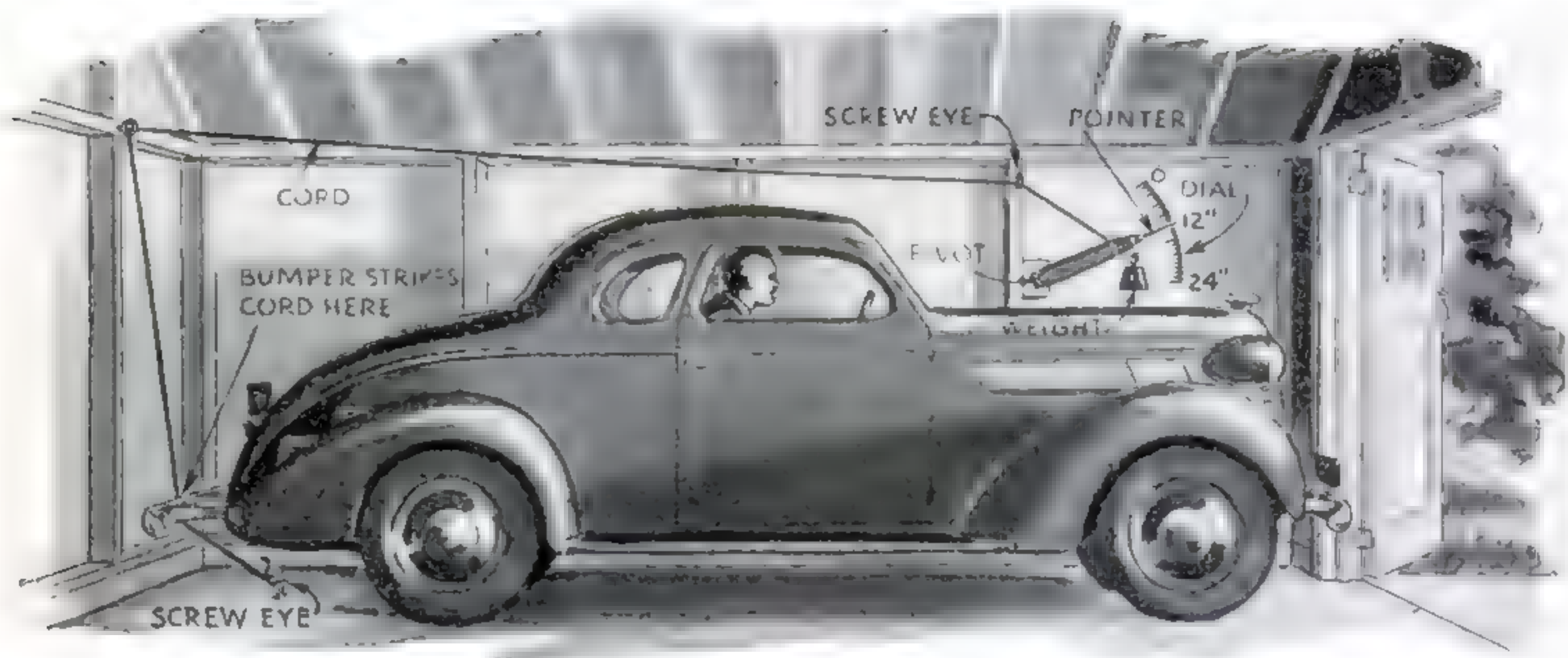
Although an amateur license is necessary to legally operate any transmitter, this ruling need not prevent you from building the circuit if you are planning to apply for your license. In constructing it, you will gain training and experience that will prove invaluable when you finally take the test.



How the parts are placed below the chassis. Follow the wiring diagram closely and compare it with the list of parts given on the opposite page



Stunts for Car Owners



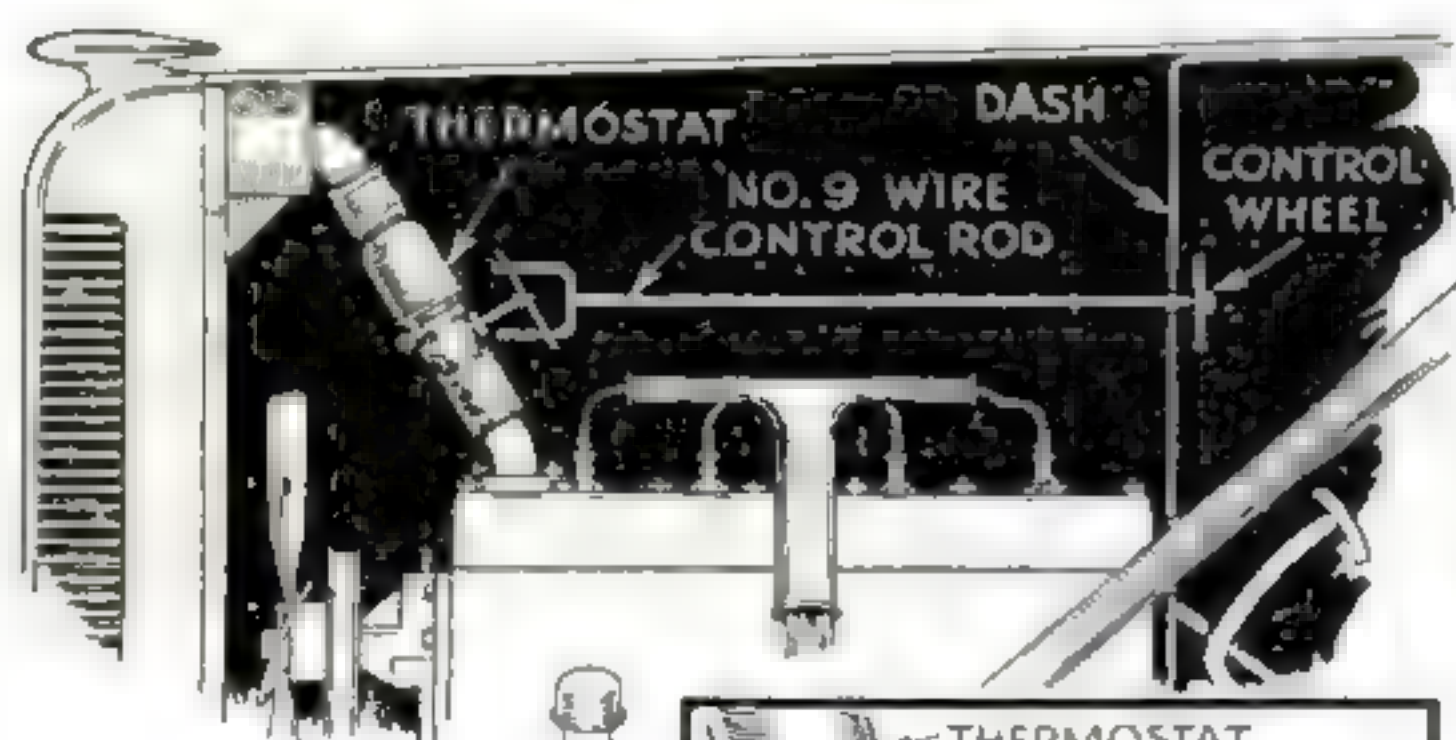
Wall Dial Helps Back Car into Garage

BACKING into a short garage without hitting the back wall was a problem I met by rigging up the simple indicator pictured above. As the car is backed, the bumper hits a strong cord attached to a floor screw eye and leading through other screw eyes to a

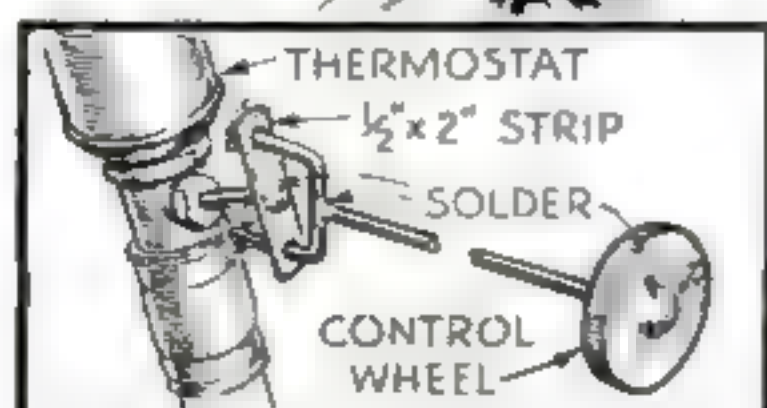
pivoted, weighted, wooden pointer on the side wall near the door. As the bumper pushes the cord, the pointer moves to indicate on a wall dial within view of the driver the distance in inches between the bumper and the back garage wall.—W. A.

Dashboard Regulator for Adjustable Thermostat

TO MAKE it possible to control the water thermostat on my car from the dashboard, I removed the regular control wheel and replaced it with a flat metal strip. A wire yoke, engaging holes in the strip, was soldered to a wire control rod leading through a hole in the dashboard, as shown below. Finally, the original wheel was soldered to the wire end protruding through the dash.—H. L. W.



The original control wheel is removed and soldered on the end of the extension rod



Asbestos-and-Metal Cover Protects Muffler Shell

MUFFLERS of automobiles can be made to give longer service by protecting them with an asbestos-and-metal covering. Wrap the muffler with several layers of asbestos paper, cut to fit, and then cover this with a layer of 20-gauge galvanized steel. The latter can be held in place either with wire lashings or with 16-gauge-steel ring clamps. Not only does this prolong the muffler's life, but it eliminates practically all ring and other noise caused by exhaust gas hitting the outer muffler shell.—E. L. D.

THIS CERTIFICATE and THIS CABLE



assure you of CERTIFIED RE-WIRING Service

CERTIFIED RE-WIRING Service means that the wiring system of your car will be put in A-1 condition, to give you better performance, faster pick-up, more economy and greater safety. The Certified Re-Wiring Certificate assures you that the mechanic is *specially trained to do the job right*—and the purple-and-gold carton with the name PACKARD on it assures you that *highest quality Packard cable will be used for replacement*. When your car needs wiring attention, new battery cables or new spark plug cables, go to the service station that uses Packard cable and that can show you the mechanic's Certificate. You'll be better satisfied with the job.



Look for this sign. Hundreds of service stations are already displaying the Authorized CERTIFIED RE-WIRING Service sign. Look for it in your neighborhood. If there is none near you, ask to see the mechanic's Certificate—and demand Packard cable:

Packard

REG. U. S. PAT. OFF.
TRADE MARK

THE STANDARD WIRING EQUIPMENT OF THE AUTOMOTIVE INDUSTRY

By burning 25% slower than the average of the 15 other of the largest-selling brands tested—slower than *any* of them—CAMELS give a smoking *plus* equal to

5 EXTRA SMOKES PER PACK



Cigarettes were compared recently... sixteen of the largest-selling brands... under the searching tests of impartial scientists. Findings were announced as follows:

1 CAMELS were found to contain MORE TOBACCO BY WEIGHT than the average for the 15 other of the largest-selling brands.

2 CAMELS BURNED SLOWER THAN ANY OTHER BRAND TESTED—25% SLOWER THAN THE AVERAGE TIME OF THE 15 OTHER OF THE LARGEST-SELLING BRANDS! By burning 25% slower, on the average, Camels give smokers the equivalent of 5 EXTRA SMOKES PER PACK!

3 In the same tests, CAMELS HELD THEIR ASH FAR LONGER than the average time for all the other brands.


Camels mean more pleasure per puff—more puffs per pack... America's shrewdest cigarette buy.



**PENNY FOR PENNY
YOUR BEST
CIGARETTE
BUY!**


Copyright, 1939, R. J. Reynolds Tobacco Company
Winston-Salem, North Carolina

CAMELS



“I know from years of experience that Camels give a longer smoke—milder, cooler, mellower”

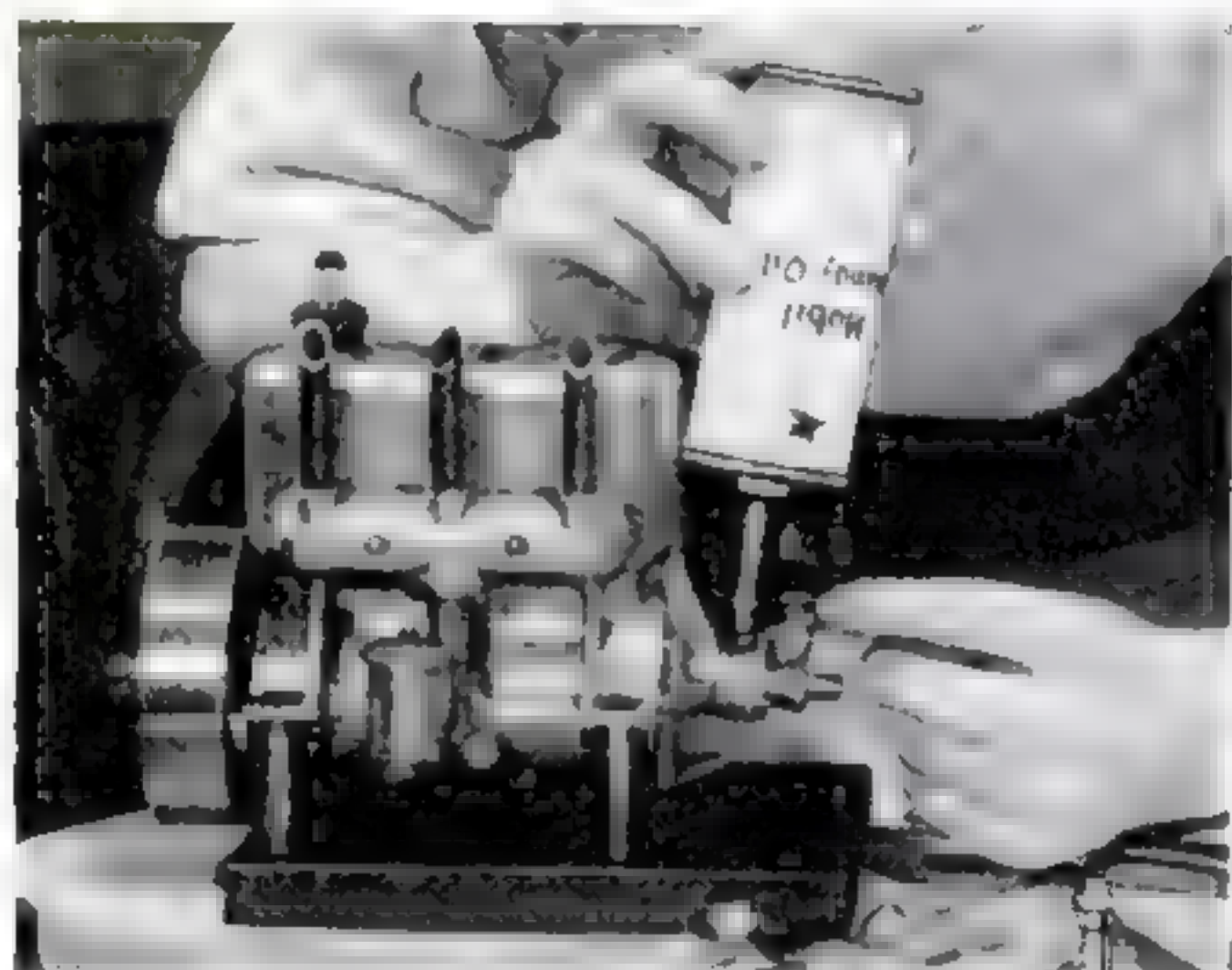
SAYS JOE WILLIAMS,
FAMOUS SPORTS EXPERT



DOES it “burn fast”—or is it “*longer-burning*”? That’s the new angle on cigarettes that is being widely discussed today. “I get an extra measure of smoking because of Camel’s long-burning feature,” says Joe Williams, the famous sports expert. “With Camels, I get an overtime amount of true cigarette contentment.” More tobacco in every Camel, *by weight—slower-burning*—they hold their ash longer (see full details, above left). No wonder Camel’s choice quality tobaccos win the praise of men and women everywhere who appreciate smoking pleasure at its best! Don’t deny yourself the enjoyment of quality when Camels, with their costlier tobaccos and unusual slow burning, give more pleasure per puff! *And more puffs per pack.*

— *Long-Burning Costlier Tobaccos*

THIS OIL KEEPS MODELS ***RUNNING SWEET!***



MOBIL HANDY OIL

It's light—penetrating—won't gum—just right for models. Use it for home appliances, sewing and washing machines, toys. Fine for automobile generators and tools. Wall bracket free with every can.



MOBIL UPPERLUBE QUIETS CAR ENGINES!



Added to gasoline, it reaches the engine as a vapor. Its special impregnating ingredient protects piston rings and valves from rust and wear. Carbon is reduced.

Buy where you buy Mobiloil or Mobilgas

Mobil Specialties

MOBILGLOSS • MOBILWAX • MOBIL STOP-LEAK
MOBIL HANDY OIL • MOBIL RADIATOR FLUSH
MOBIL WINDOW SPRAY • MOBIL UPPERLUBE
MOBIL HYDROTONE • MOBIL SPOT REMOVER



BY THE MAKERS OF MOBIL OIL

Homemade Battery Tool Keeps Terminals Clean

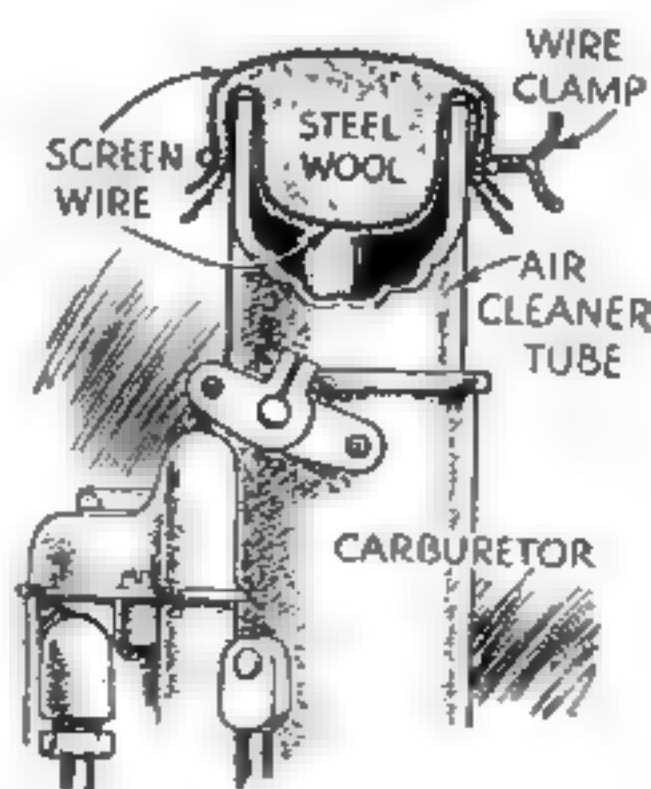


TO MAKE a handy car-battery tool, flatten out one end of a piece of metal pipe or tubing, and solder in a number of short, stiff wires. Then saw the other end of the pipe into sections, as shown in the illustration above. Spread the sections outward with a taper plug to the dimensions of the battery posts on your car, and file the section edges sharp. This end of the tool can then be used to scrape corrosion from the posts, while the other is employed to brush it away, and for other general battery-cleaning purposes.—C.H.W.

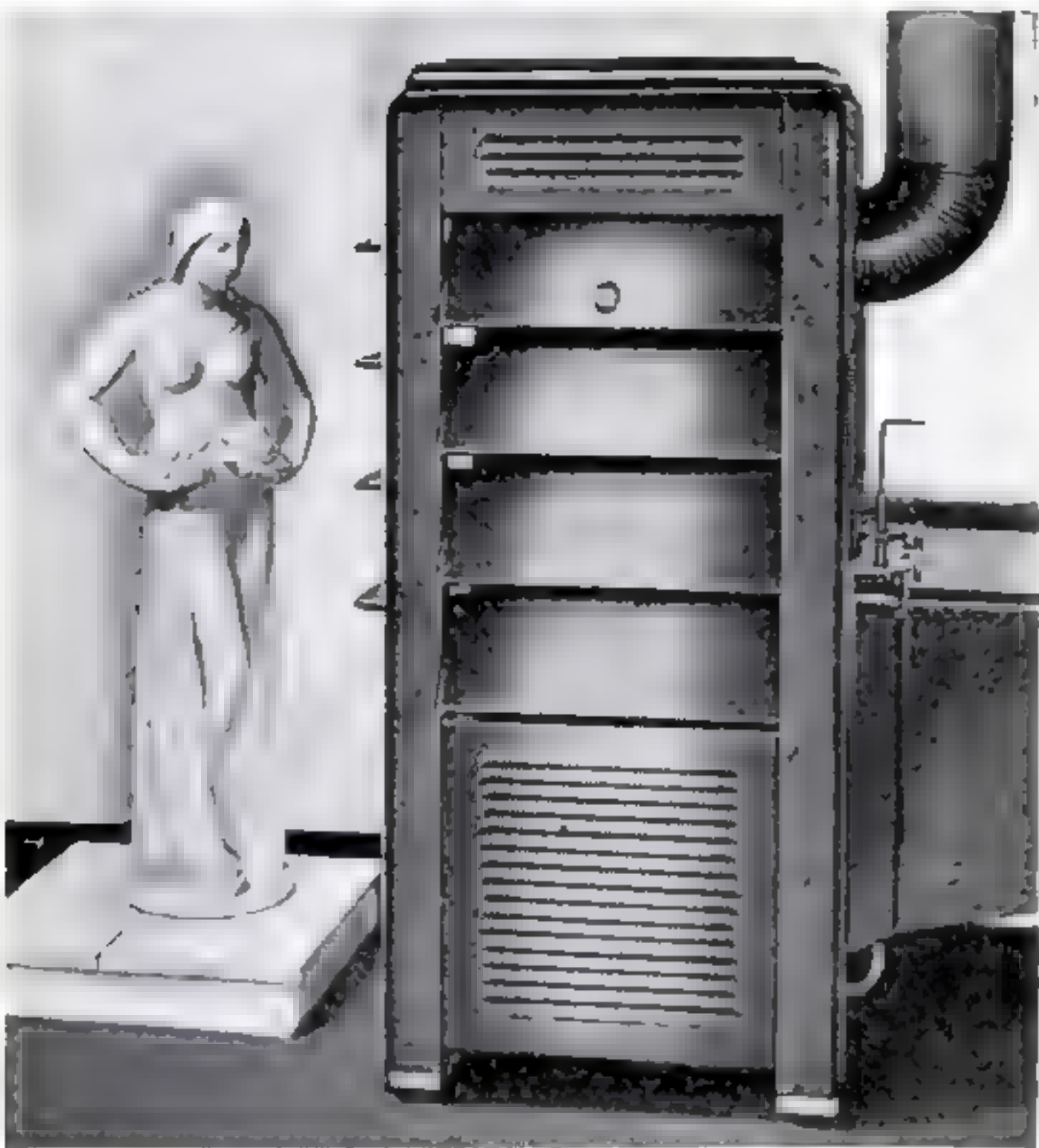
Improvised Air Cleaner Made with Steel Wool

A TEMPORARY air cleaner for an automobile motor can easily be made from wire window screening and steel wool. Cut out a section of screening and place it over the open end of the cleaner pipe leading to the carburetor, pressing it down into the pipe to form a pocket, which is then filled with steel wool. Place another piece of screening across the top, and bind the

overhanging edges to the pipe with a wire clamp, as shown in the illustration at the left, to prevent the improvised cleaner from being drawn into the pipe. This arrangement will serve satisfactorily until a regular cleaner can be installed.—F.N.



HEAT RAYS PHOTOGRAPHED TO SHOW HEATER'S COMFORT ADVANTAGES!

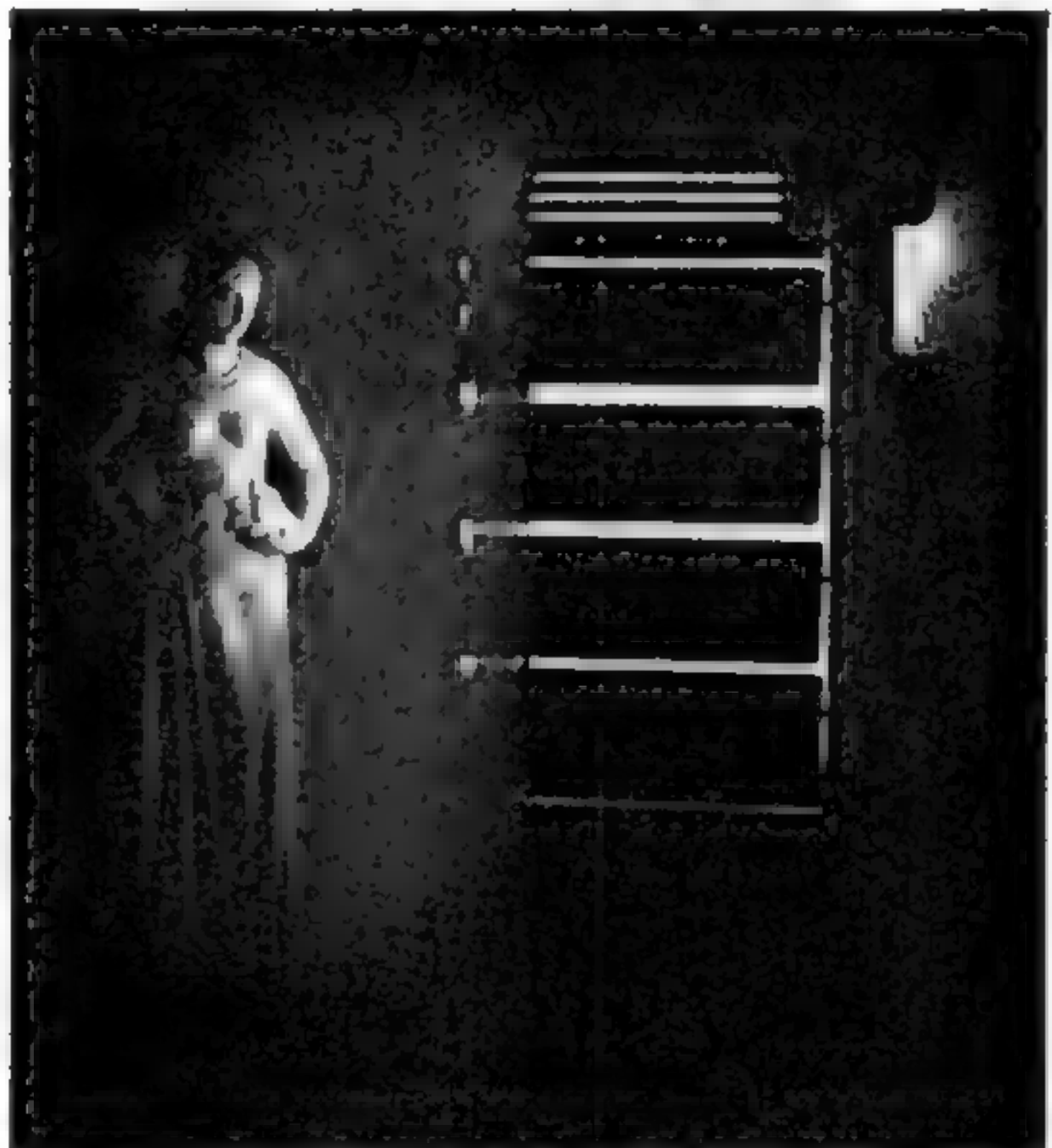


SUPERFEX photographed in ordinary light.

Infra-red photography shows how oil burning SUPERFEX Heater directs radiant heat rays outward and downward. No fans or blowers needed.

To show how this SUPERFEX Heater gives more comfort, engineers turned to infra-red photography. SUPERFEX directs radiant heat, which is made up of infra-red rays that are invisible to the naked eye, but are active on certain kinds of photo film. Here at left, is SUPERFEX in ordinary light. Magic! Below—here's the same SUPERFEX as at left, photographed in the dark on infra-red film. See how the directed, radiant heat rays—like heat from the sun—strike the statue. Heat rays heat anything they strike. This is how SUPERFEX brings comfort to anyone in the living zone.*

*The same SUPERFEX photographed in the dark on infra-red film. Statue lighted by heat rays which reach entire living zone.**



SUPERFEX circulates heat; but, more important, its patented adjustable shutters direct cozy warmth outward and downward—end cold, drafty floors—without fans or blowers that increase operating expense and cause uncomfortable floor drafts. And *only* SUPERFEX has these unique patented shutters!

Dial control regulates heat volume. Operates quietly and evenly without attention. Burns wide variety of inexpensive fuel oils available everywhere. SUPERFEX brings a new sense of comfort to homes, stores, filling stations, etc. Wide choice of sizes with attached reservoirs. Many models also available with constant level valve (plus thermostatic control if desired) for use with outside fuel supply. Radiant heaters, too. Easy purchase plan. See your Dealer. Coupon brings FREE descriptive booklet.

**The living zone is the lower part of your rooms—where you live—the space where you especially need heat.*

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Oil Burning

HEATERS



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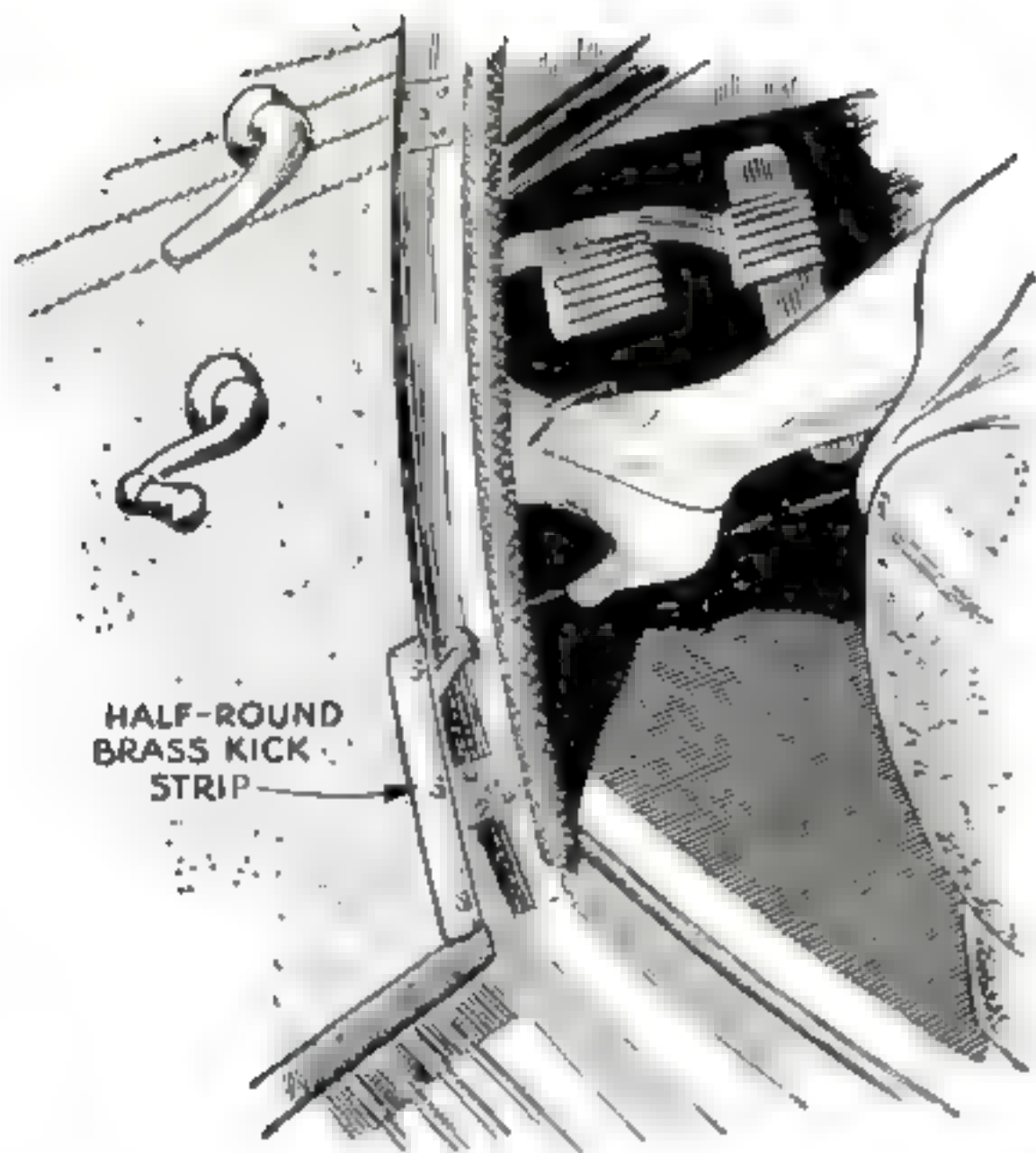
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Kick Strip on Door Edge Protects Car Upholstery

UPHOLSTERY on the inside edge of the automobile door next to the driver's feet, I've found, soon wears out. To protect this wear spot, I attached a piece of $\frac{1}{2}$ " half-round brass, six inches long, to the edge at the spot where the wear began to show. This improvised kick strip ended the trouble.—J.M.M.

Spark-Plug Tester Made from Old Screw Driver



AN EFFICIENT, insulated tool for use on such jobs as testing car spark plugs, can be made from an old screw driver that has been discarded. Obtain a common rubber grip of the type used on bicycle handlebars, coat it on the inside with gasket shellac, and then fit it over the screw-driver handle. It may be found necessary to trim the handle a little in order to obtain a good fit.—F.H.

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IT'S TOO LATE TO MAKE THIS NECESSARY LIST AFTER FIRE STRIKES

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KEEP THIS BOOK IN A SAFE PLACE

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... until I told them about the mysterious things I can do with my

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RCA offers you two new Electronic Labs . . . With either of them, you can build your own radio . . . your own telegraph practice set . . . radio announce system and Magic Relay with which you can do many fun-full, fascinating things!

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For example, you can build a radio receiver of your own. Or you can practice telegraph code on a telegraph practice set. You can hook a microphone into the family radio set and talk through it from another room. And with the Magic Relay, which you can also build, you'll have fun galore! It enables you to mysteriously ring bells, turn the radio on and off, and do many other unusual stunts.

The parts in the RCA Electronic Labs are similar to those used by famous radio engineers. Complete instructions make everything easy to build. And prices are as low as \$7.50. See these fascinating Labs at your RCA Victor radio dealer's—or any store where toys are sold. Big thrills await you.

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LAPSTREAK SKIFF. Designed with a skiff type of hull and lapstreak construction, this boat is immensely strong and durable. It requires no soaking, being always ready for use.



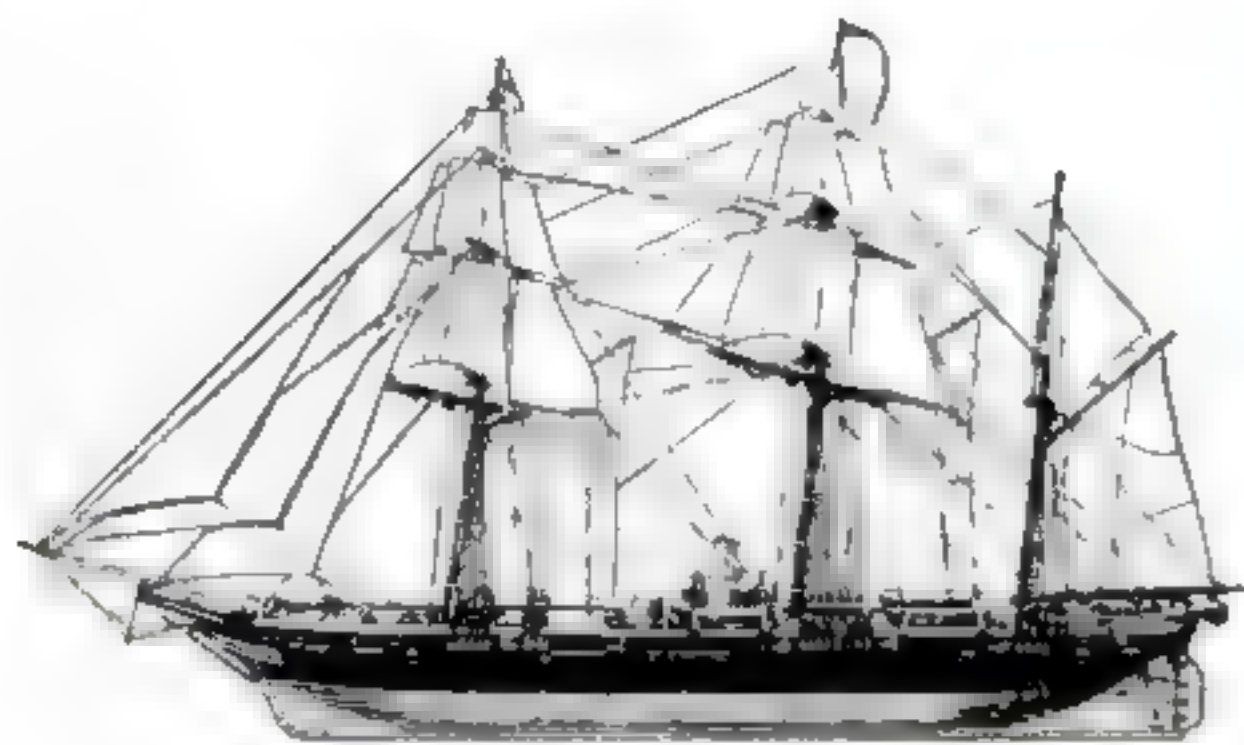
The boat is 13' 9" long, has a 4' 7" beam, draws 4" of water, weighs 225 lb., carries as many as seven passengers, and costs approximately \$35 to build. Any outboard from 1 to 16 h.p. may be used, and the speed varies from 5 to 45 m.p.h., depending upon the motor. Blueprint No. 363-R, 50 cents.

MODEL OF THE "ALABAMA." A miniature of the famous Confederate raider will enhance your mantelpiece or is a present that anyone

(Continued on page 215)

Plans for the Workshop

(Continued from page 214)



would appreciate receiving. The model has a 21½" hull and is 28" over all. Blueprint Nos. 335-336-337-R, \$1.50.

INLAID BUFFET SET. For the amateur craftsman who wishes to turn something a little different on his lathe, this set of two candle-



sticks and a fruit bowl makes an ideal project. Black walnut and white holly with an inlay of vermilion wood were used for the set shown. Blueprint No. 307A, 25 cents.

For over seventeen years, **POPULAR SCIENCE MONTHLY** has been supplying home workers with blueprints for a wide variety of projects. Those pictured above are just a few of the many designs available. There are plans for models, furniture, radio sets, boats, toys, and miscellaneous novelties. Send a self-addressed, stamped envelope for the complete list.

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Tests prove that "Zerone" makes a perfect mixture with water and that you lose little or none by evaporation or separation. Radiator losses are due mainly to leaks, sudden stops, etc. Where there is boiling, the losses are of the whole solution, "Zerone" and water.

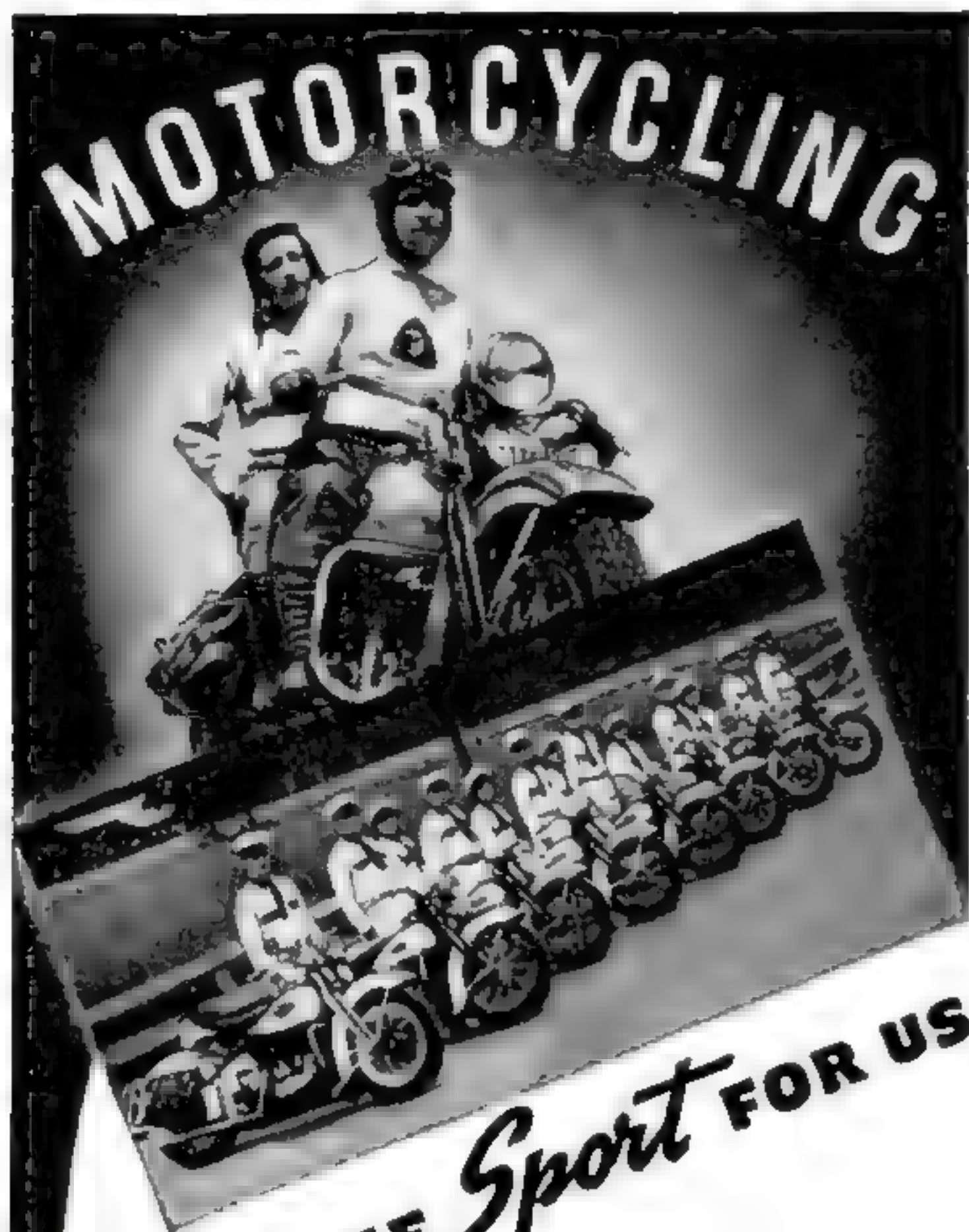
"Zerone" in a clean cooling system prevents rust and corrosion, which reduce operating efficiency. It gives better dissipation of engine heat, avoids power losses. Protect your car with "Zerone" this very day! Remember, it's only \$1.00 a gallon, 25¢ a quart.



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CONSTRUCTION KITS Simplify Model Making

THE picturesque two-masted square-rigged ships that sailed the seven seas during the nineteenth century are typified in the *Malek Adhel*, a brig built in 1840 for the Pacific trade. A model of this vessel, 33" long over all, is shown above, and you can make a duplicate with our special construction kit No. 6S, which costs \$9.75 (25 cents additional west of the Mississippi River and in Canada). Frame-and-plank construction, like that of the original ship, is used.

Each of our kits contains all the necessary raw materials for making a ship model. In the case of the *Malek Adhel*, a special feature is that finished blocks, deadeyes, thimbles, hearts, belaying pins, and anchors are included, thus simplifying your work considerably.

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R.	U.S. cruiser TUSCALOOSA, 11¼" long.....	1.00
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Z.	H.M.S. BOUNTY, 8½" hull, 11½" overall.....	1.50
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3M.	Yacht NOURMAHAL, 8¼" long.....	1.00
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7M.	Fleet of nine modern U.S. fighting ships, including superdreadnought, light cruiser, aircraft carrier, submarine, and five destroyers; scale, 1" equals 100'.....	1.50†

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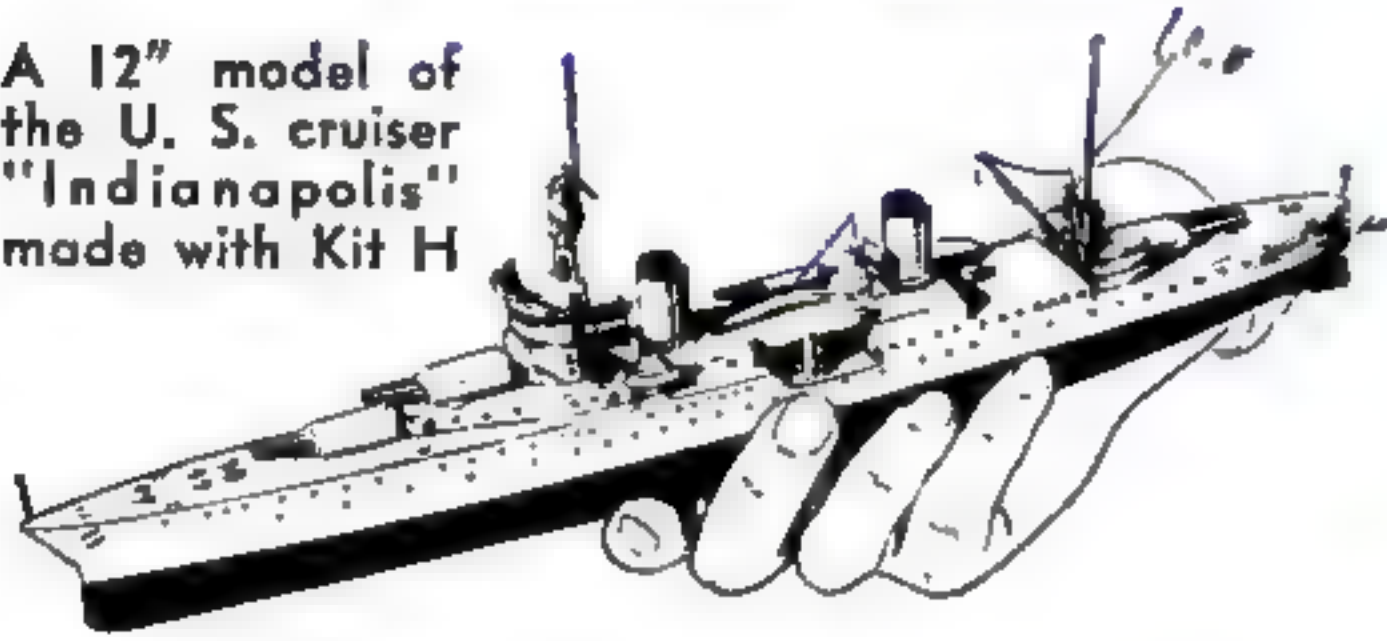
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L.	Farragut's flagship HARTFORD, steam-and-sail sloop-of-war, 33½" hull, 41" over all.....	8.45*
Q.	Privateer SWALLOW, a Baltimore clipper, 12½" hull, 20" over all.....	4.95†
V.	Clipper SOVEREIGN OF THE SEAS, 20½" hull, 26" over all.....	4.95†

(Continued on page 217)

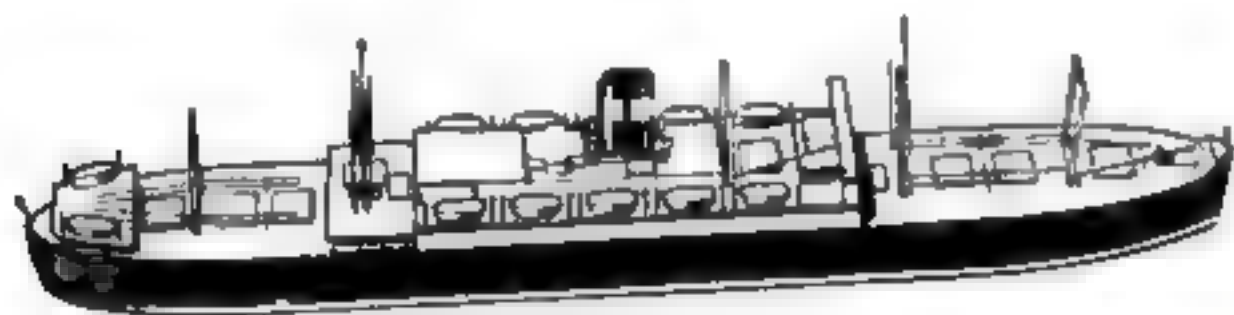
Kits Aid Model Makers

(Continued from page 216)

A 12" model of the U. S. cruiser "Indianapolis" made with Kit H



- Y. Trading schooner, Maine type; 17½" hull, 22½" over all..... 4.90†
- 2S. U.S. Navy destroyer PRESTON, 31½" long 5.95*
- 3S. CONSTITUTION ("Old Ironsides") 21" hull, 31" over all..... 6.50*
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- 5S. Coast Guard Patrol of 165-ft. type, 20½" long 4.95*
- 6S. Brig MALEK ADHEL, 20" hull, 33" over all; frame-and-plank construction 9.75†
- 8S. Fishing schooner BLUENOSE, 17½" hull, 22" over all 4.95†
- 9S. New Bedford whaleboat, with complete equipment, 14" long 2.75†
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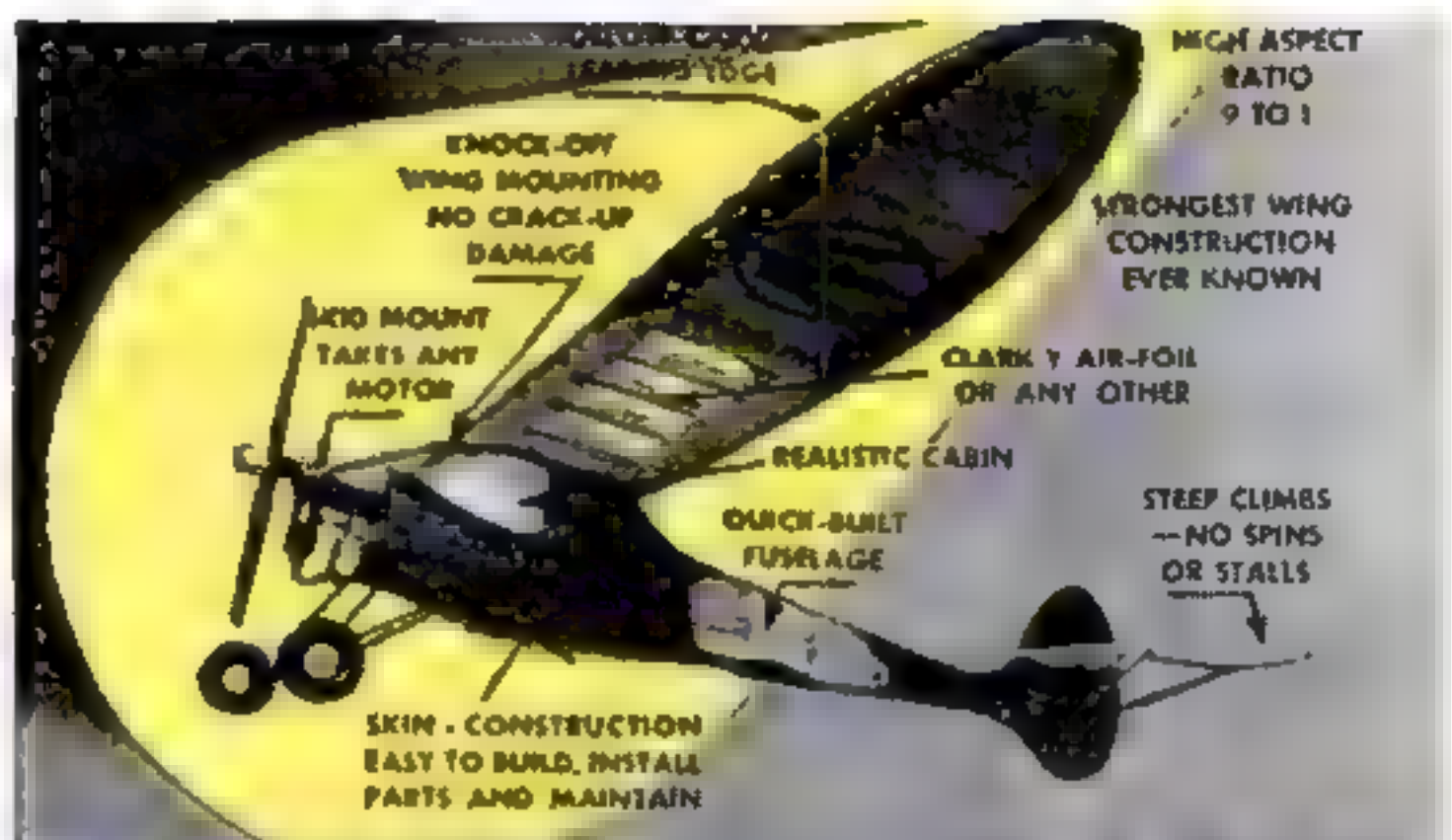
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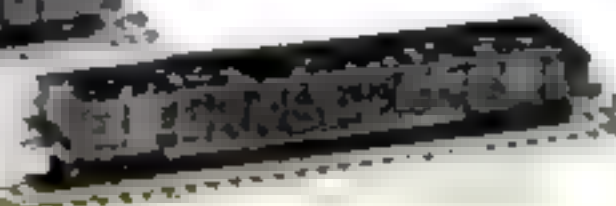
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Staining Ties and Poles of a Model Railway

NIGROSINE, usually obtainable at large paint stores, makes an inexpensive black stain for "creosoting" model railway ties and telegraph poles. Add a little of the stain to alcohol in a large tin can with a tight-fitting cover. Put in the ties, replace the cover, and shake vigorously. The unused stain may then be bottled and saved. Poles are stained by using a brush.

It is well to stain track baseboard gray before ballast is applied so that any spots where the ballast does not stick will not be conspicuous. A quick-drying stain may be prepared by adding enough white lacquer to lacquer thinner to make the solution milky, and then adding black lacquer until the desired shade of gray is obtained.—A. F.

Holder for Carrying Tools on Farm Machinery

TOOLS carried on farm machinery are not so likely to be lost if they are suspended from a rod as shown below. In this case a cream-separator disk holder was used, and it was simply run through a hole in the framework of the plow. The tools are then slipped on the holder.—NORVAL WRIGHT.



A wire holder—in this case an old cream-separator disk holder—prevents the loss of tools from a plow



Boxes and Jars Decorated with Twisted Paper

ATTRACTIVELY shaped bottles and jars, as well as flowerpots, cigar boxes, and other containers, can be decorated and their commercial origin concealed by wrapping them with twisted crêpe paper as illustrated.

Cut the crêpe paper lengthwise across the bolt in strips about $\frac{1}{2}$ " wide and pull them gently to take out the elasticity. Then roll each piece between the thumb and forefinger. The strands may be braided or used singly, and are fastened with paste to the object being covered. Various colors may be used according to the effect desired. The finished covering is glazed with one or two coats of white shellac.—FRANK CAPORAE.



Closely wound strands of twisted crêpe paper cover these containers and conceal their commercial origin

Rubber Band Aids in Marking Tops of Wooden Posts

WHEN the tops of a number of wooden fence or trellis posts have to be cut off uniformly to give a neat appearance, an easy way to mark them is to slip a strong rubber band around the post and adjust it at the correct height for either a level or a slanting cut, as desired. Then run a pencil around the band, remove it, and saw to the mark.—A. Z.

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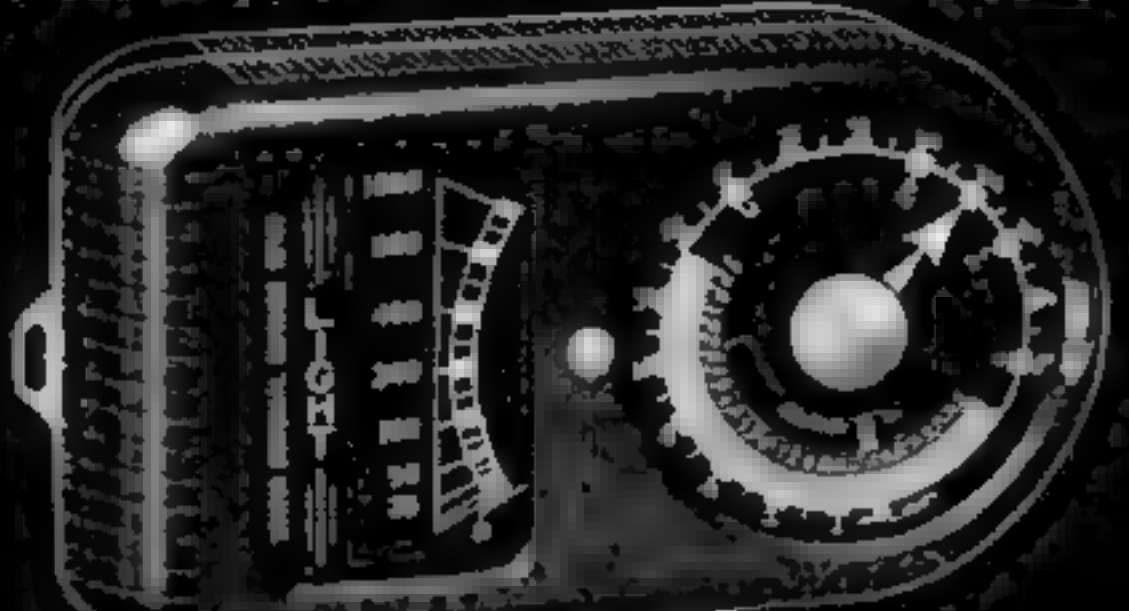
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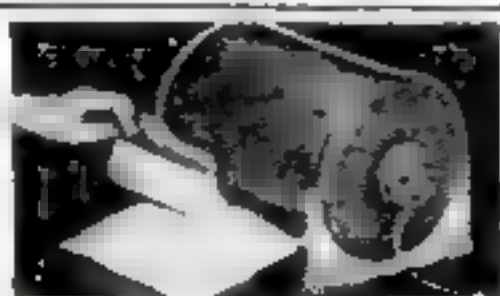
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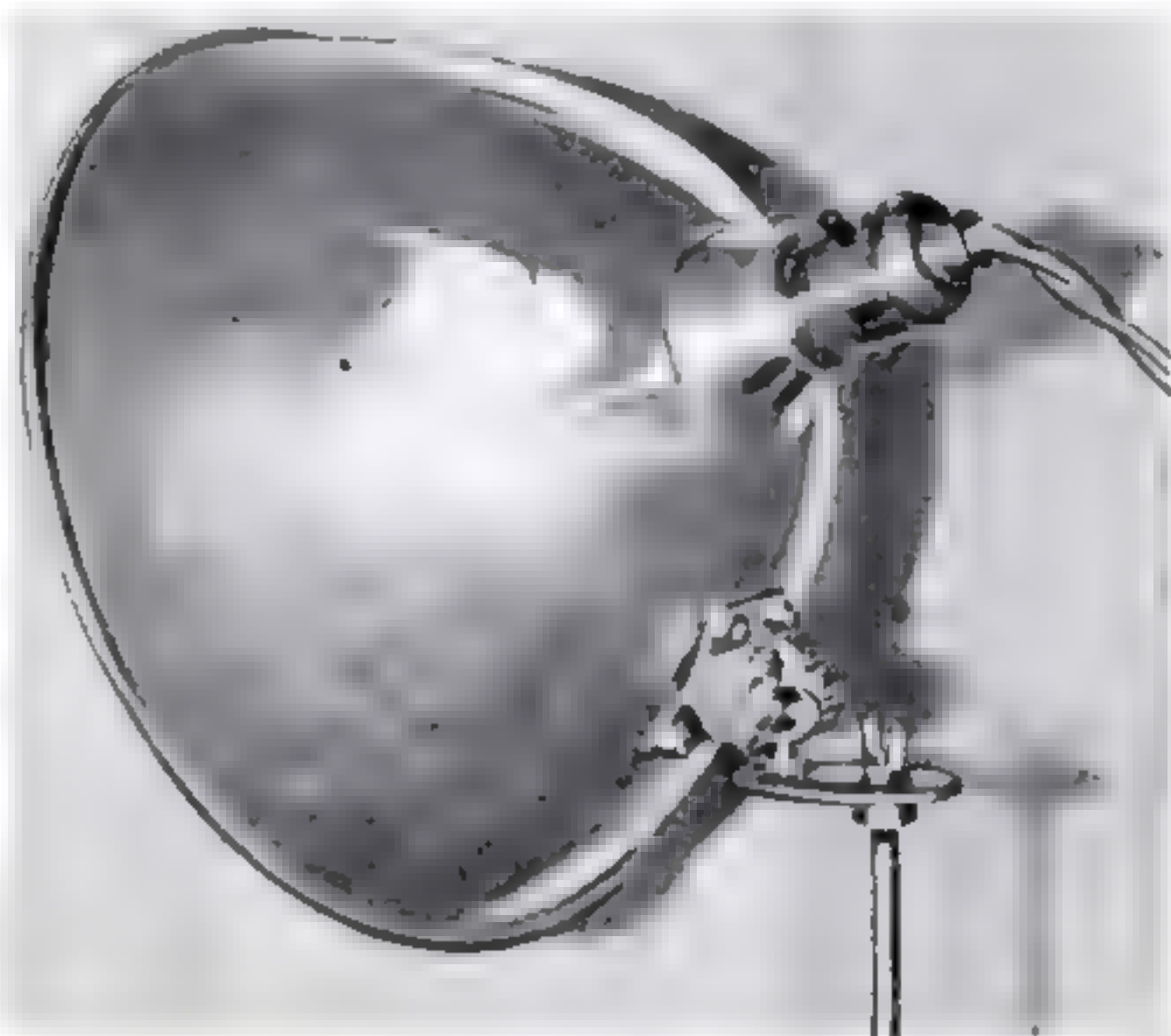
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Old Auto Mirror Supplies Useful Tilting Joint

THE reflector of a photo lamp may be tilted to any desired angle if a discarded rear-vision mirror from an old auto is trimmed and fastened to it with small bolts as shown. The attachment may be tinned or given a coat of enamel so that it will present a neat appearance.—WALTER HOAG.



The discarded rear-vision mirror is trimmed and fastened to the reflector as an adjustable joint

When Chemicals Run Short

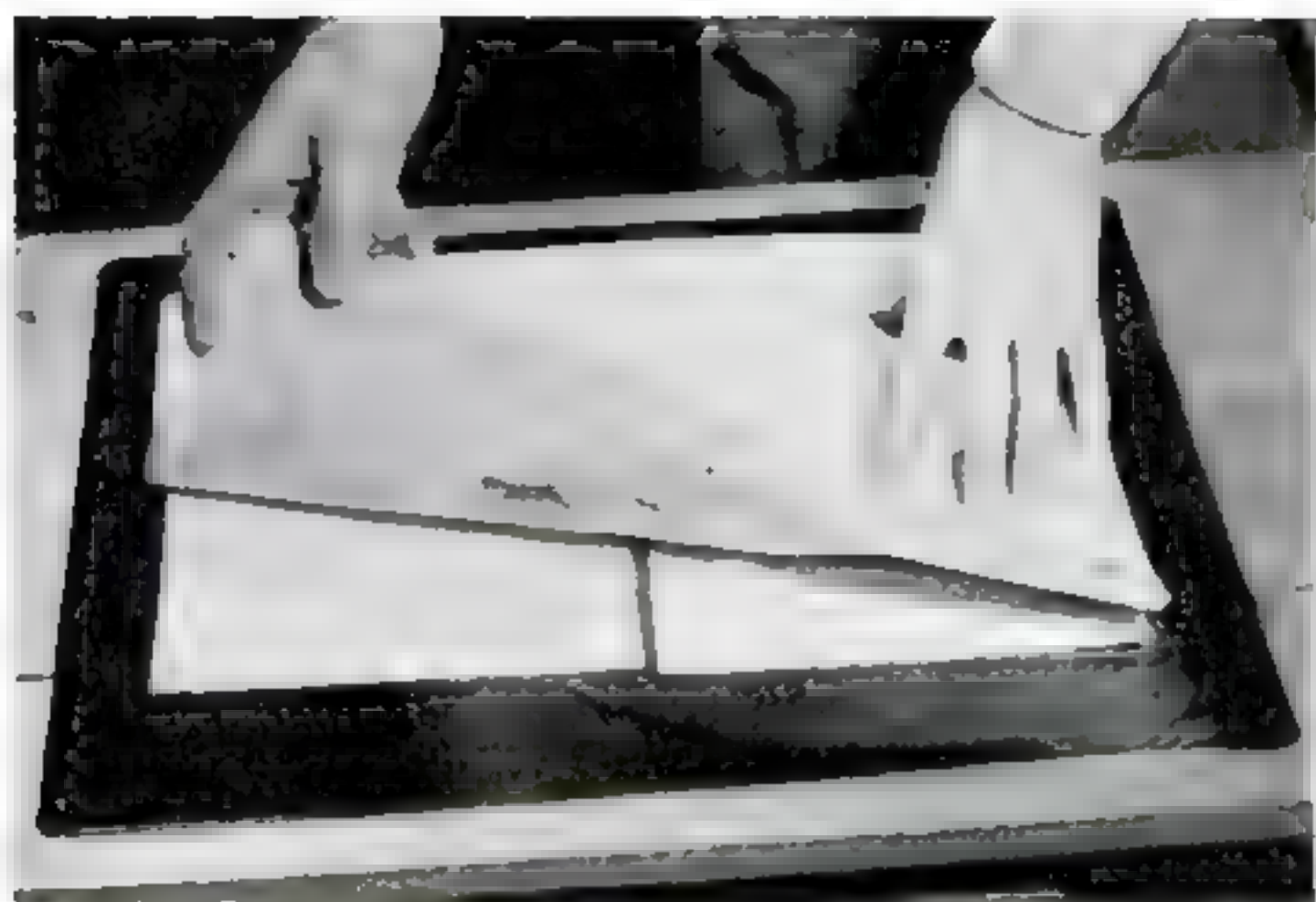
THOSE who prepare their own developing solutions will find that ordinary washing soda may be used in place of carbonate of soda in case of necessity. It is not so pure chemically as photographic carbonate, but gives good results. If the supply of hypo for fixing runs out, sulphite of soda, although not as effective, may be used in the proportions of 1 oz. to 5 oz. water.—T. M.

Cutting Filter Mounts

IN PREPARING cardboard mounts for gelatin camera filters and other work which requires the cutting of circles from cardboard or very thin wood, an efficient tool may be made by mounting a stiff, single-edged safety razor blade on the end of a block of wood as shown. The blade is held with two thumb tacks, and a third thumb tack acts as a pivot for the material to be cut.—R. S.



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Keeping Squeegeed Prints from Curling Too Much

PHOTOGRAPHIC prints dried on squeegee plates to give them a high gloss have a tendency to curl excessively when the atmosphere is dry. Often this curling is accompanied by a series of creases sometimes called oyster-shell markings. When time is not an important factor in drying, such curling and creasing can be eliminated by placing the plate in a horizontal position and, after the excess water has been removed, covering the prints with several layers of newspaper to retard drying. The rate can be regulated by varying the number of thicknesses.

Jars Used as Hypo Tanks for Fixing Roll Films

AMATEUR photographers who develop roll films by the tray method can make small tanks to hold the film while in the hypo bath. Glass jars not less than 3" in diameter will serve if given several coats of black paint on the outside. Double the strip of film, then redouble it until it will slip easily into the jar, but do not crease the folds. Cover the jar tightly and stand it in a dark and cool place.—HERBERT J. BRAUN.

Roll Film Floats Under Board While Being Washed

BECAUSE of its tendency to curl tightly, roll film is difficult to wash thoroughly even in running water. If you can plug up the sink to hold water or can make use of the bathtub, simply thumb tack the film, emulsion side up, on a piece of board a little wider and longer than the film. Run cold water into the sink or tub to a depth of about 6" and float the board with the film side down. As the hypo soaks out of the film, it sinks to the bottom while the film remains in the hypo-free surface water until it has been completely washed.—THOMAS F. MAHER.

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How to Get a Large Negative from a Miniature One

IT IS sometimes necessary to make a large negative from a miniature negative so that it may be retouched or used with some particular type of contact paper. The best method of doing this without loss of detail is to obtain a box of slow-speed process film of the desired size, cut one piece into strips for testing exposure, then put the miniature negative in the enlarger, focus it to the desired size, and expose the test strip of film. When the correct exposure time has been found, expose and develop a large process film. This will be a transparent positive.

After the positive has been washed and dried, place it in a printing frame, emulsion side up, and lay over it a test strip of process film, emulsion side down. Make a brief exposure with a distant light and continue testing, if necessary, until the proper exposure has been found. Then expose a large piece of film in the same manner. This will give a negative without the loss of detail that comes from attempting to copy an enlarged print from a miniature negative in the ordinary way.—C. W. R.

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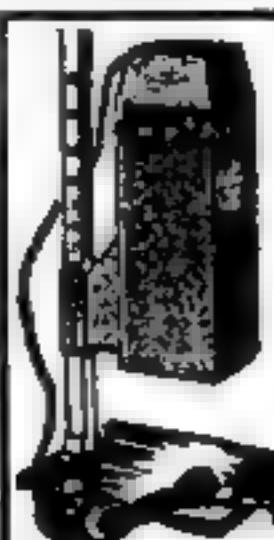


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Saving the Vanishing Mountain Sheep

(Continued from page 139)

ica, then coming down and hoofing it back to camp. When you've done that, you've done something!

There are, Nichol is convinced, no more than 700 bighorns in Arizona, exclusive of the Boulder Dam recreational area and the Grand Canyon National Park, where there may be 700 more. Twenty years ago they probably totaled 4,000.

The reasons? The principal one is that in the worst part of the depression the Southwest was overrun by amateur prospectors filled with story-book notions of the old West. All were armed, all tried to live off the country, all shot sheep at every opportunity. The great drought struck the country about that time, and the animals were forced to go to open water. As holes and springs were few, and the prospectors found them, hundreds of sheep were shot. A fad for collecting heads also had its effect. Any dry head brought twenty-five dollars or more and a really good green one sold for up to \$200.

But, as bad as the conditions would appear, there is still hope for the bighorns, Nichol believes. The first step, he thinks, would be the development of permanent water in the ranges. Food is no problem, the survey has shown, and the animals are not utilizing one percent of the available forage. In other words, if water were developed, the herds could be increased 100 percent and still be within the food supply.

The most serious enemy of the bighorns is man. After that, Nichol believes, is the great golden eagle, which occupies the same range as the sheep and raises its young close to the places where the sheep raise theirs. Lions take sheep, but in many of the ranges they are either absent or rare, and so are not the problem they are in a deer program. Coyotes and bobcats kill lambs, and curiously, the little desert fox does, too. In one range, Nichol found where foxes had killed a lamb and he shot a fox with lamb meat in its stomach.

The wild burros which are in some places plentiful on the Arizona deserts may also be classed as enemies of sheep. They eat the available forage, but, more important, they hang around the water holes and keep the sheep away. Heretofore, the answer has been to close the season and leave the animals to the predatory animals and meat hunters.

But now things seem on the way to being done. If they are done,—if the sheep ranges are patrolled, if water is developed, if the burros and the predatory animals are thinned down—the sheep can come back.

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Students Run Model City

(Continued from page 119)

the counter, weighing out groceries, collecting money, making change, registering the intake on a miniature cash register, adding their receipts, keeping books. "This," I commented to Mrs. Fuller later, "sounds suspiciously like glorified arithmetic." She only smiled.

In this school, geography and history mean more than so many words and a few pictures. These youngsters cover the world in their search for information.

How is oil produced? How do trees become lumber? How is transportation progressing? Several visits into the near-by oil fields gave the boys an intimate view of the derricks. A few weeks later there stood on a laboratory table a working model of a rig, built by their own hands. Behind it I saw a drawing portraying a typical oil field and its underground formation. They made a small sawmill of such excellence that several western fairs displayed it to thousands of visitors. Photographs of locomotives and trains, a miniature station built during spare hours, and a tiny streamliner told something of recent railroad history.

Assignment of much work by student leaders is part of the sugar-coating. "Take our current program, 'progress,' for example," said Mrs. Fuller. "All seem to enjoy their work, and none has ever complained about his studies. Partly," with a smile rich in wisdom and experience, "because Jeanne calls for reports during chamber-of-commerce meetings. I don't know what phase of a subject they will develop, but I'm sure they will devote considerable study to the problem before next meeting day."

The fifth-graders were assigned recently to trace the rise of agriculture. How does agriculture relate to a modern home? These younger students have been studying the taming of wild animals, leading to a consideration of cows, horses, and chickens. Some decided to study soil, how it is changed by the wind, what part vegetation plays in saving the soil, and what elements must be present to develop a pretty grass lawn.

Many of us older boys and girls had to wait until school days were a sweet memory before learning how and why the civic wheels go 'round. Why delay these necessary experiences? "Children," emphasizes Mrs. Fuller, "already are part of life, and should not be forced to wait until maturity to begin feeling their importance and accepting their share of responsibilities." Her idea has given Cat Canyon a community of substantial little citizens of whom any city could be proud.

Two Ways to Keep Walls of Spray Booths Clean

THERE are two simple methods of treating the interior of paint spray booths to facilitate cleaning. One is to brush on a heavy coat of cheap gear grease over the walls, exhaust fan blades, and stack, and cover the walls with sheets of wrapping paper or newspaper. Remove these as often as they become unsightly and burn them immediately. Fresh paper should then be applied.

The second method is to brush on a heavy coat of dope made from 5 lb. gear grease, 10 lb. whiting, 2 large bars of yellow soap, and 1 gal. of water. Heat the water to boiling, cut the soap into chips and stir until dissolved, add the gear grease and stir until the mixture is smooth, then add whiting gradually until the mixture is as thick as can be spread with a brush. Allow it to cool before applying a thick brush coat to the spray booth. This material can be washed off with hot water and renewed whenever necessary. This latter method eliminates the necessity of peeling off the messy papers.—R. G. W.

Emery and Cellulose Cement Used for Mending Iron

IN THE absence of special cements for mending iron, repairing a broken knife handle, or even patching a small leak in a hot-water tank, a mixture that sticks well and dries very hard may be prepared by adding powdered emery to model airplane cement or household cellulose cement. When using the mixture for filling small holes, it is best to apply two thin coats, each composed of equal parts of emery and cement, rather than one heavy coat. Aluminum bronzing powder may be used instead of emery, but the cement does not have quite so hard or ironlike quality as the emery.—FRANK A. FLOREK.

Grass for Display Purposes Made by Dyeing Excelsior

ONE grocer who needed some artificial grass as a background for a window display used excelsior or wood straw. A package of dark green household dye was dissolved in boiling hot water, and the excelsior immersed in the solution, stirred well with a wooden stick, and left for a few hours. The surplus water was then gently pressed out, and the excelsior spread out thinly in a warm place to dry. It should not, however, be placed in the sunlight for drying as the strong rays might bleach the dye. Many unusual effects may be had by using other colors than green and combining them.—MORRIS KATZ.

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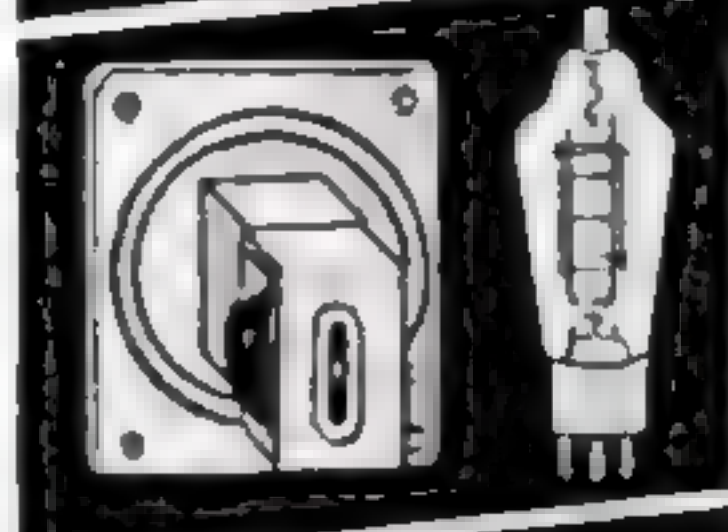
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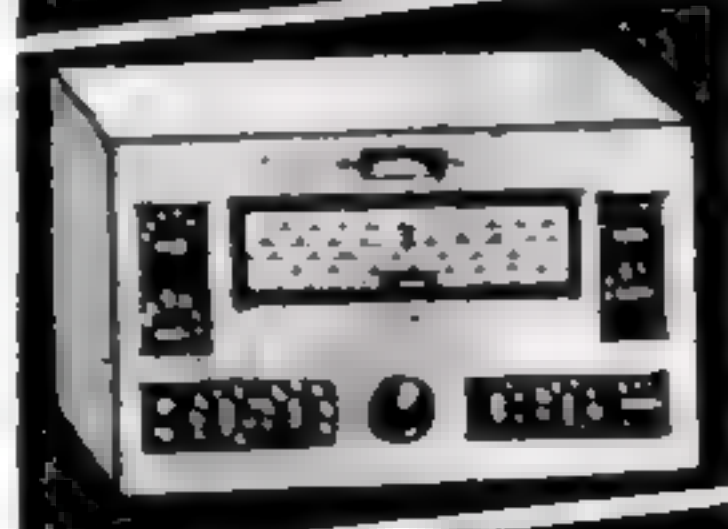
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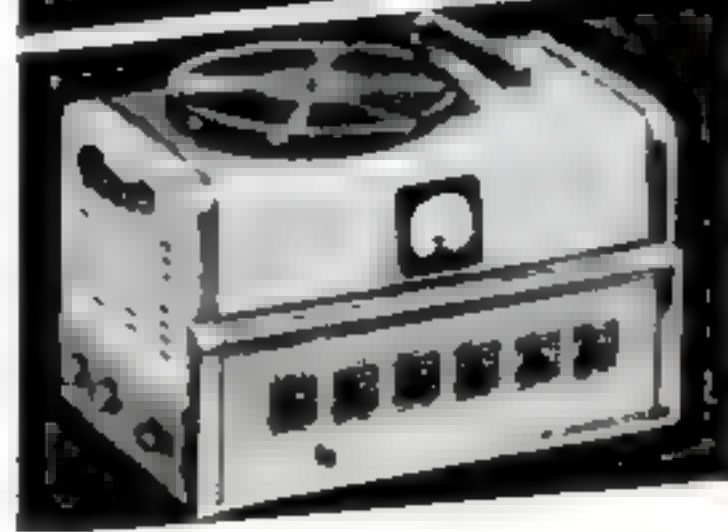
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(SEE PAGES 212 and 225)

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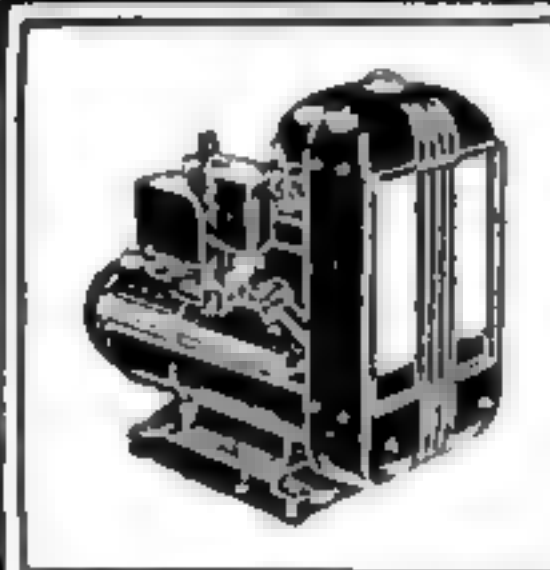
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World's Largest Pearl

(Continued from page 105)

Dr. Roy W. Miner, marine-life expert at the American Museum of Natural History, New York City, and other leading scientists have examined it and pronounced it one of the most interesting natural-history additions of recent years.

The pearl measures nine inches in length, five and a half inches in breadth, and six inches in height. Its superlative size and weight make it of great scientific value, but its odd shade eliminates it as a jeweler's prize. The largest ornamental pearl known weighs hardly one seventieth as much as Cobb's and is valued at \$45,000. At this rate, if the pearl found near Boligay were perfectly round, it would be worth more than \$3,000,000!

Of special interest to the scientists who have examined it are the questions: How did the pearl get its curious shape? How old is it?

In answer to the first query, Dr. Hilario A. Roxas, head of the Bureau of Science of the Philippine Department of Agriculture and Commerce, advances the theory that long ago a piece of brain coral was dislodged by the tide and carried into the shell of the giant South Sea clam. Then, just as an oyster forms a pearl by coating an irritating grain of sand with the lustrous material which makes up the smooth lining of its shell, the clam enveloped the piece of coral in mother-of-pearl, increasing the thickness of the coating year after year. So huge had the pearl grown when it was discovered that the two halves of the clamshell could barely close.

How long the creation of the pearl required nobody knows. One expert estimates that 600 years were consumed in the process. He thinks that the clam began the slow formation of the pearl at least two centuries before Columbus discovered America!

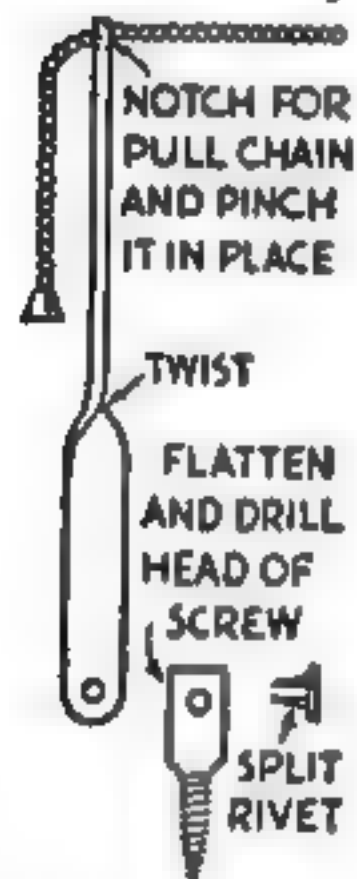
POPULAR SCIENCE Question Bee

WELL, let's see how you came out in the Question Bee on page 142. The list below gives the correct answers. Compare your results with it, and give yourself five points for each one you had right. A total score of 75 to 85 is good; 90 or better is excellent.

- | | | | | |
|------|------|-------|-------|-------|
| 1. b | 5. a | 9. b | 13. c | 17. c |
| 2. b | 6. c | 10. d | 14. a | 18. a |
| 3. c | 7. c | 11. c | 15. c | 19. b |
| 4. b | 8. b | 12. c | 16. a | 20. c |



Lever Holds Pull Chain Away from Table Lamp



HIGHLY polished wooden table lamps are sometimes marred because the pull chain rubs against the finish. This can be avoided by holding the chain out from the lamp with a lever made from a piece of aluminum $\frac{1}{8}$ " thick and $\frac{1}{4}$ " wide, as shown. Note that it is twisted a half turn and has a notch in the top to hold the pull chain. The lower end is drilled so that it can be pivoted

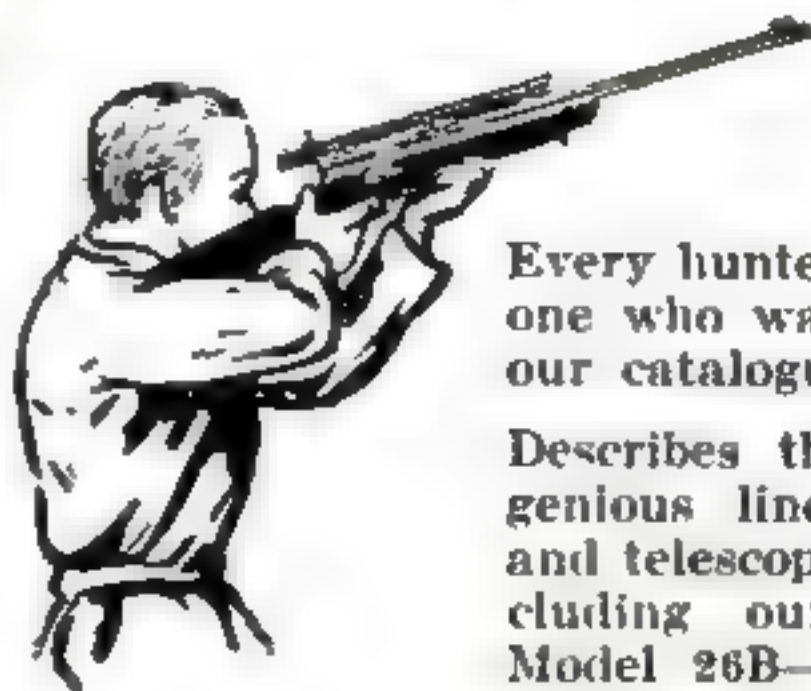
by means of a split rivet to the head of a small screw, which has been flattened and drilled for the purpose. Pinch the notch so the chain will not come out.—E. J. HOBERT.

Harness Spots Conceal Bolts Used for Furniture Repairs

IN REPAIRING a piano bench that is subjected to rough usage, I fastened the joints with $\frac{3}{16}$ " roundhead stove bolts and then capped the heads with $\frac{1}{2}$ " harness ornament spots. These spots, which may be purchased from any harness shop in either brass or nickel finish, merely need to have the two prongs sharpened so they can then be driven into the wood. First cover the spots with soft cloth to save the polish, and then force them in place by using a hardwood block hollowed to fit.—ELMER H. PINTER.

FREE—

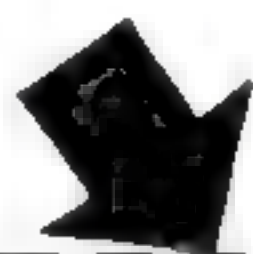
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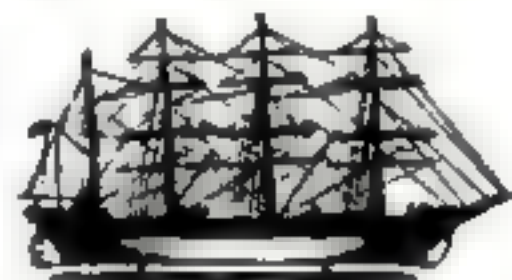
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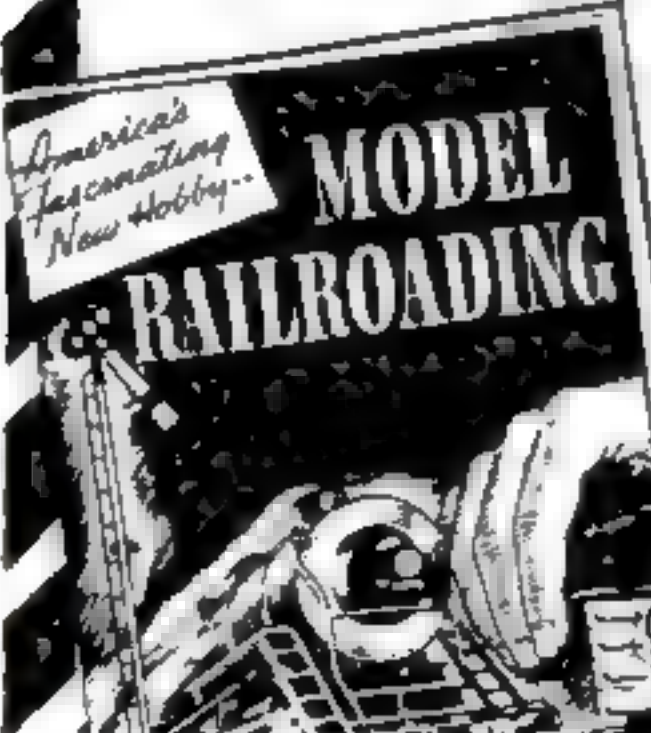
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Uncle Sam Arms

(Continued from page 59)

my's main naval force to harass the coast.

To take a more unlikely but conceivable possibility, suppose an alliance of powers simultaneously attacked both coasts of America. It would take the full force of our battle fleet to engage and destroy one of the enemy fleets. This accomplished, our fleet could transit the Canal and cope with the enemy in the other ocean—but in the meantime, the Army must hold the coastline there and, strengthened by the new defense program, it will be equal to the mission.

Still the Navy remains our first line of defense. Alone among the world's great nations, the United States is safe from mass attack by air or by land so long as its fleet commands its waters. And the Navy's \$800,000,000 share of the new armament program well fits it for the task.

Already the steel is being fabricated for two giant 45,000-ton battleships, long talked about and now to become actualities—the *Iowa* and *New Jersey*. Heading a list of twenty-three war vessels whose construction is to start this year, they will be the world's largest and most powerful warships. By way of comparison, either the *Iowa* or the *New Jersey* would have the speed and gun power to overtake Britain's 42,100-ton battle cruiser *Hood*, the biggest man-of-war afloat today, and blow it out of the water.

Other naval funds just voted will continue work on vessels started in earlier programs, which are now commencing to show large-scale results. Major warships that soon will join the fleet include the 14,700-ton aircraft carrier *Wasp* and the 10,000-ton cruiser *Helena*. Next spring will see the launching of the 35,000-ton battleship *North Carolina*, one of six of her class under construction—the first capital ships we have built in fifteen years.

Funds for 500 new naval planes will also augment the Navy's squadrons of carrier planes, and of the mighty four-engined craft that have taken over scouting and patrol duties from the Navy's destroyers in recent years. Operating from coastal bases or from an attendant "mother ship," these long-range patrol bombers have entirely made over the modern conception of a naval base. Even the tiniest coral atoll becomes as formidable as a fortress bristling with guns, when "fortified" by dredging an entrance channel into its lagoon for the big planes' tender.

Thus, seldom-heard names like Palmyra Island and Johnston Island appear in a \$63,000,000 program, now under way, to create

(Continued on page 232)

How to Bore Long Holes Accurately by Hand

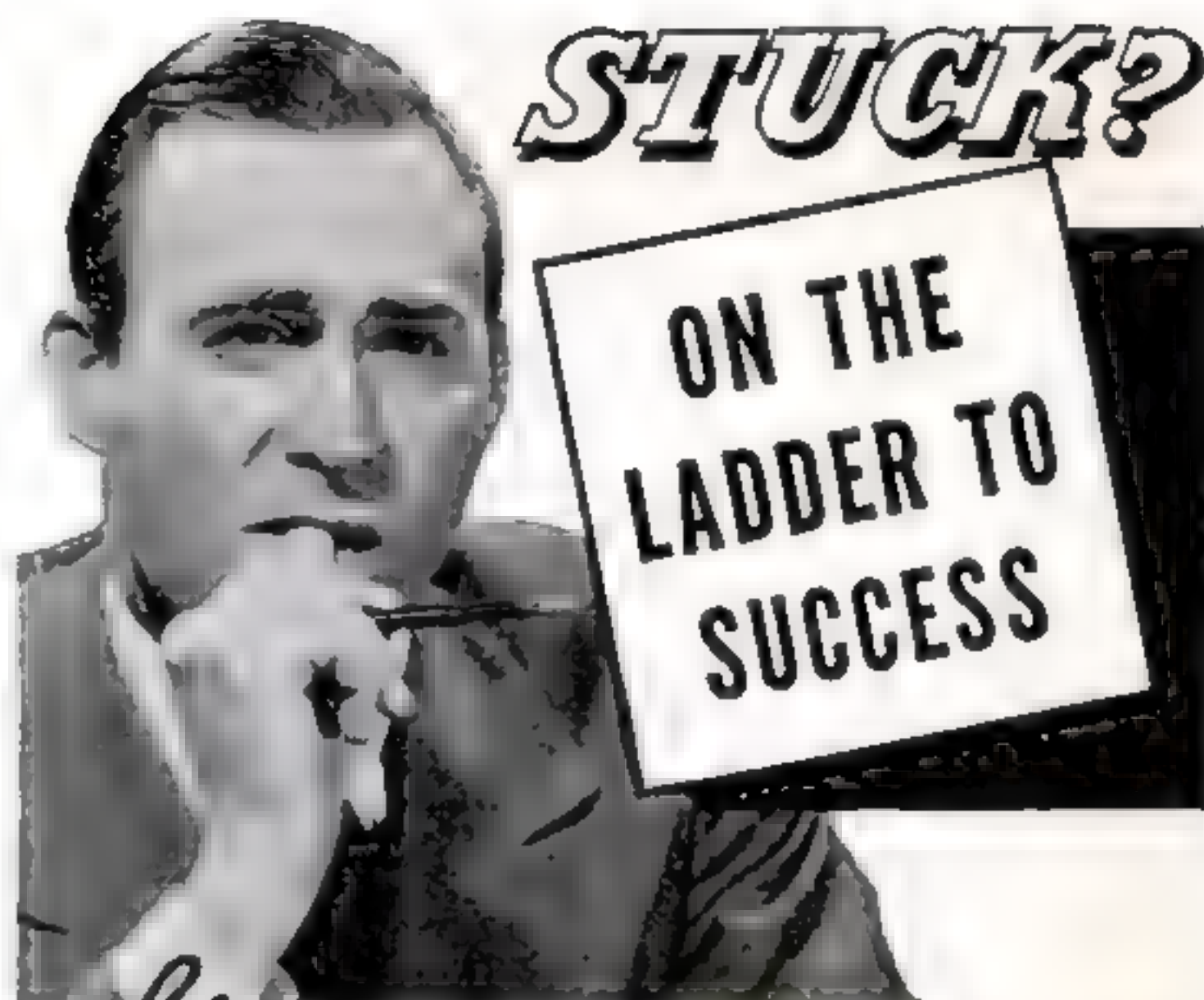
WHEN power tools are not available, comparatively long holes can be bored accurately through the center of table lamps and the like by the following method: Square the work as perfectly as possible with a plane and center each end accurately. Start the bit in one end, place the head of the brace against the body, and hold the work in front with the other hand. The bit is now given two full turns, after which the work is allowed to turn in the left hand for one quarter of a turn. The bit is turned another two full turns, then another quarter turn is given the piece. This is kept up until the bit has gone about halfway through. It is then withdrawn, and the hole is bored into the opposite end in the same way. In many cases the holes will meet squarely, but if they do not, a long rat-tail file may be used to straighten them out with a few good strokes.—HAROLD ENGLISH.

Fireproofing Sawdust for Use as an Insulating Material

SAWDUST, if available in large quantities, is sometimes used for heat insulation by packing it in the walls of a barn, shop, or other building where better and more expensive insulation is not warranted. It must, however, be properly prepared. For fireproofing, it is customary to add 5 lb. monoammonium phosphate and 5 lb. borax to every 100 lb. of the dry sawdust. To prevent decay and discourage insects, 3 lb. of sodium fluoride are added. Dampening the sawdust before the chemicals are mixed in will make the task less dusty, but the final mixture should be absolutely dry before it is packed in the walls, and the walls also must be of such a type that there is no possibility that the sawdust will become wet, which would be quite dangerous. Mix the sawdust and chemicals by repeated shoveling and stirring, or use a concrete mixer if one is available.—K. T. B.

Key Handles Dipped in Color for Easy Identification

IF SEVERAL keys of somewhat similar appearance are carried, time can be saved in selecting the proper one for any lock by coloring the top part or handle of each a different color. Merely dip the end in colored enamel or lacquer and let it dry. The keys can be more quickly identified by their colors than by filing notches or using other common methods of marking them.—L. F. W. PARKS.



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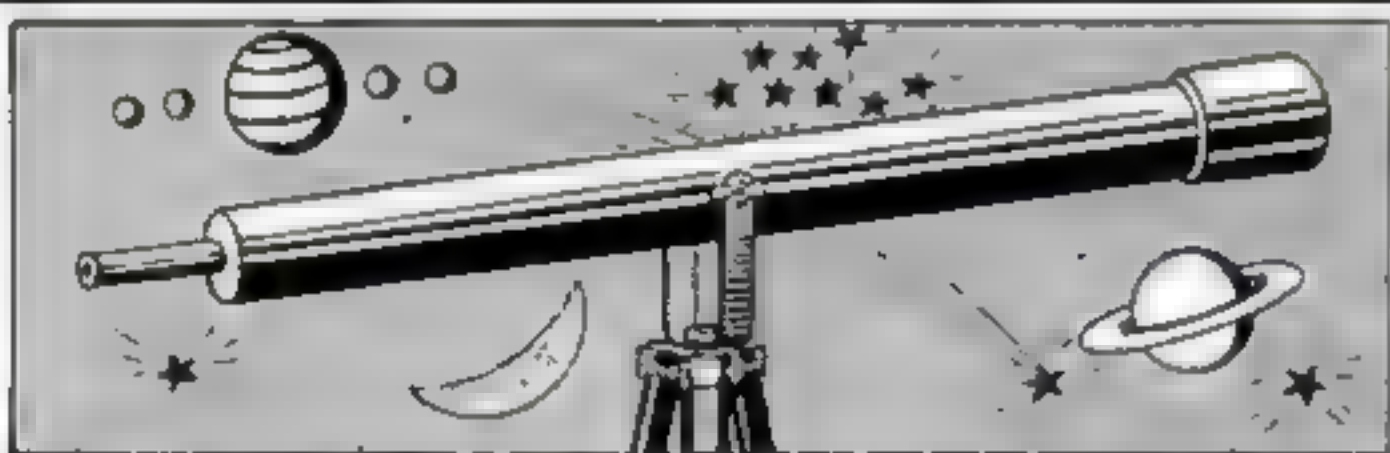
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Uncle Sam Arms

(Continued from page 230)

new naval air bases and expand existing ones. These pin points of land in mid-Pacific will form links in a far-flung patrol line, together with Hawaii, Midway Island, and Kodiak, Alaska.

On the Atlantic side of the Panama Canal, strategically flanking the approach from Europe, lies our island territory of Puerto Rico—defenseless for many a decade. A \$30,000,000 program just begun will transform it into a "Hawaii of the Atlantic" to guard the Canal. Plans include a huge \$1,800,000 dry dock suitable for "servicing" fighting ships, and a \$9,000,000 patrol-plane base, at San Juan harbor; a \$9,000,000 Army air base; and a garrison of 9,000 Army men fully equipped with coast-defense artillery.

Side by side with these martial moves, another kind of preparedness program, no less vital to our defense, goes forward. In Akron, Ohio, for example, a leading maker of auto tires is filling a \$185,000 Army contract for gas masks. A New York manufacturer of printing presses is turning out recoil mechanisms for antiaircraft guns. It sounds like 1917, when all the resources of industry were drafted to supply munitions. And it is—with a difference.

This time we won't be caught unprepared. The Army's secret files at Washington list 10,000 manufacturers who have volunteered to cooperate in time of war—and what they can make, from mess kits to howitzer shells. Most of the items can be put into mass production at short notice. But there are just fifty-five "critical" articles so hard to make, or requiring such special tools, that they could be turned out in quantity only after heart-breaking delays.

Therefore the Army is placing \$14,250,000 worth of "educational orders" for the most critical of these supplies with a hand-picked group of industrial plants. Already the manufacturers are puzzling over blueprints, fashioning the unfamiliar tools needed, and learning how to make the devices, not in a desperate race against time, but now, before the emergency arrives. When the trial order has been filled, all the tools, gauges, jigs, and dies will remain the property of the United States Government and will be kept ready for use by the same practiced hands in time of need. Thus, if war comes, a signal from Washington will mobilize overnight the whole machinery of the world's greatest industrial nation.

Laying in strategic raw materials will close a remaining chink in our armor. Indispens-

(Continued on page 234)

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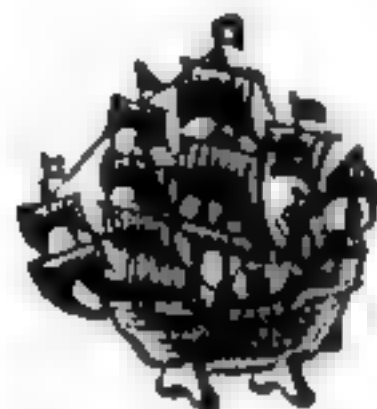


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SHIP MODEL MAKING



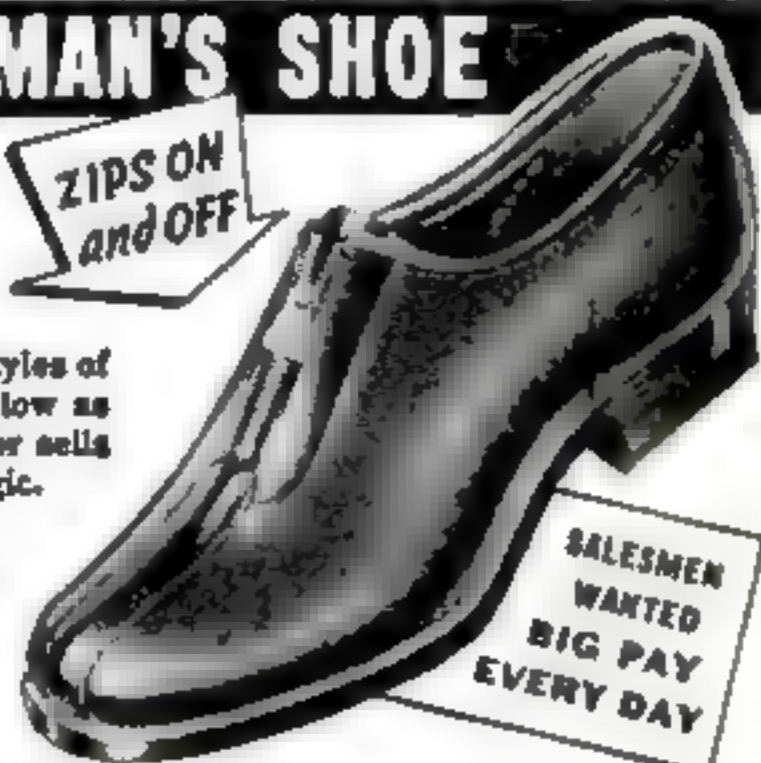
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Uncle Sam Arms

(Continued from page 232)

sable for the alloy steel of guns, armor, and munition-plant tools, manganese and chromium are among the few but vital war commodities that we must import. Others that we lack within our borders include tin and rubber. In time of war we might not be able to get them readily, if at all. So we are going to buy huge stocks of them now, and store them on Army and Navy reservations—to be rationed out only in national emergency.

And these are just the high lights of a vast defense program whose all-embracing scope may be gauged by two final examples.

By surveying a "short cut to Asia," unused by ships today because of its dangerous and uncharted passages through the Aleutian Islands off Alaska, the U. S. Coast and Geodetic Survey will open the great-circle route to American naval operations.

At the opposite end of the globe, an official U. S. Government expedition to Antarctica will stake out American claims to areas that may some day become naval air bases—and extend the Monroe Doctrine against encroachment by foreign powers, in the Western Hemisphere, clear to the pole!

Thus, from the Arctic to the Antarctic, Uncle Sam serves notice, "No Trespassing." He speaks softly, as is his custom, but in these troubled days he finds it wise to carry a whopping big stick.

Nature: Master Chemist

(Continued from page 199)

bark from a small branch of half-inch diameter. Apply a drop of strong sulphuric acid to the inner side of the bark, and to the outer side of the woody branch. In a few minutes, small red flecks will appear. This indicates the presence of a compound called salicin, which has been used in medicine as a tonic. It is one of the many products that nature's laboratory manufactures from carbon dioxide and water.

Not all the substances in a plant come from these sources, however. The magnesium in chlorophyll is drawn up through the roots, from the soil. Other elements, including potassium and manganese, are likewise obtained through the roots.

A banana stalk is extremely rich in potassium. Take a small piece of the tough skin from the end of a banana, place it in a loop of platinum or nichrome wire, and hold it in the blue Bunsen flame. Soon burning to ash, it tinges the flame with a violet color, a characteristic property of potassium compounds.

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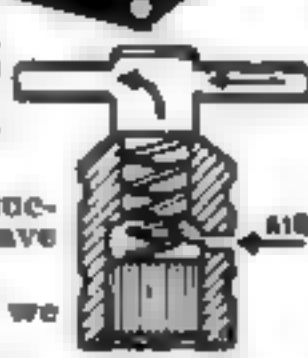
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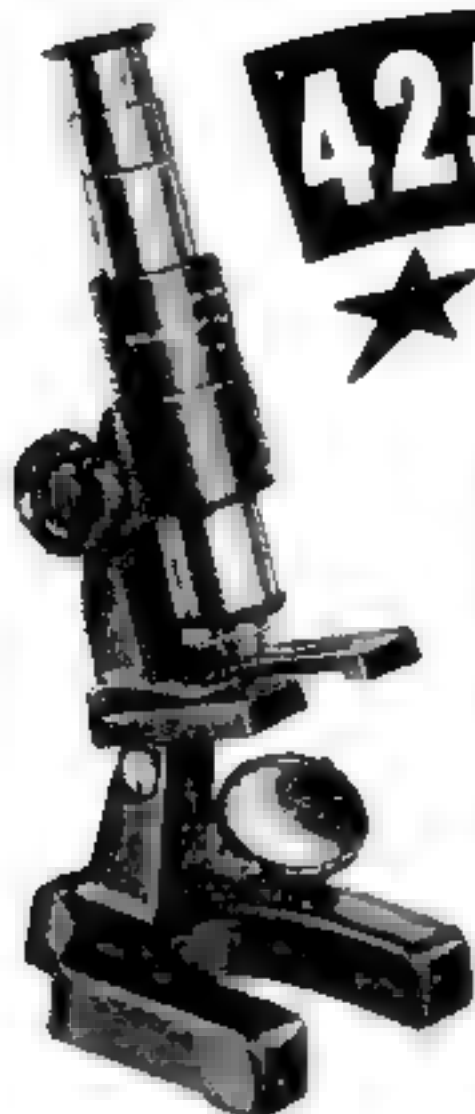
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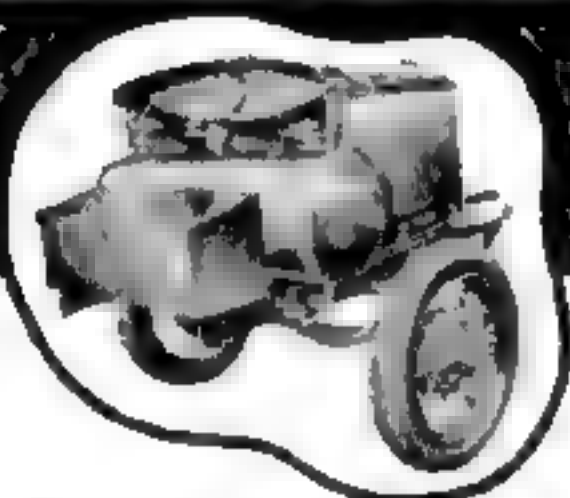


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Testing Your Microscope With Diatoms

(Continued from page 193)

piece of tissue or lintless cloth. Then do not touch the glass surface with anything but tweezers.

Although Canada balsam can be used for mounting diatoms, its index of refraction is so near that of the specimens that maximum detail is not easy to obtain. There are special mounting media made for diatom work. You might, for experiment, try such media as clear lacquer and liquid petrolatum.

If the diatoms have been strewn on the cover glass, the water must be permitted to evaporate before the mounting medium is added. Place a bell jar over the specimen until the water has evaporated and the diatoms are thoroughly dry. Then let a drop of the mounting medium fall on the cover glass. Place a tiny drop of the medium in the center of the slide, and bring it down into contact with the cover glass. Turn the slide over, and press the glass carefully into place. If you are going to use an oil-immersion lens, use a very thin cover glass such as No. 1.

For slides on which the diatoms are arranged in patterns, prepare a thin solution of gelatin, which you can buy in sheet form at any drug store, and add an equal amount of acetic acid. Ordinary mucilage can be used, if desired. With a dissecting needle or toothpick, spread a very thin film of the adhesive on the center of a clean slide, and let it dry. Put the slide under a dissecting microscope or on the stage of an ordinary instrument set for a fairly low power. With the single-bristle brush, transfer the diatoms one at a time to the gelatin-coated surface. When a diatom is in position, breathe gently on the slide. This moistens the mucilage or gelatin and makes the diatom stick to it. When the arrangement is complete, add the mounting medium and cover glass in the usual way. Use broken bits of cover glass to prevent the diatoms from being crushed.

For single diatoms or a few in a group, a guide ring is desirable, so you can find the specimens on the slide without a lot of hunting. If you have a turntable, place the slide on it after the gelatin has been applied, and with blue, red, or other bright-hued water color, draw a ring on the slide. Make the ring as small as possible. Then place the diatoms inside this ring.

Label all diatom slides so they can be identified with reference to the place where the specimens were found. In this way, you can build up a sort of "diatom directory" of your neighborhood, and later know where to look for any kind you may want.

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(SEE PAGES 212 and 223)

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LOG SAWS

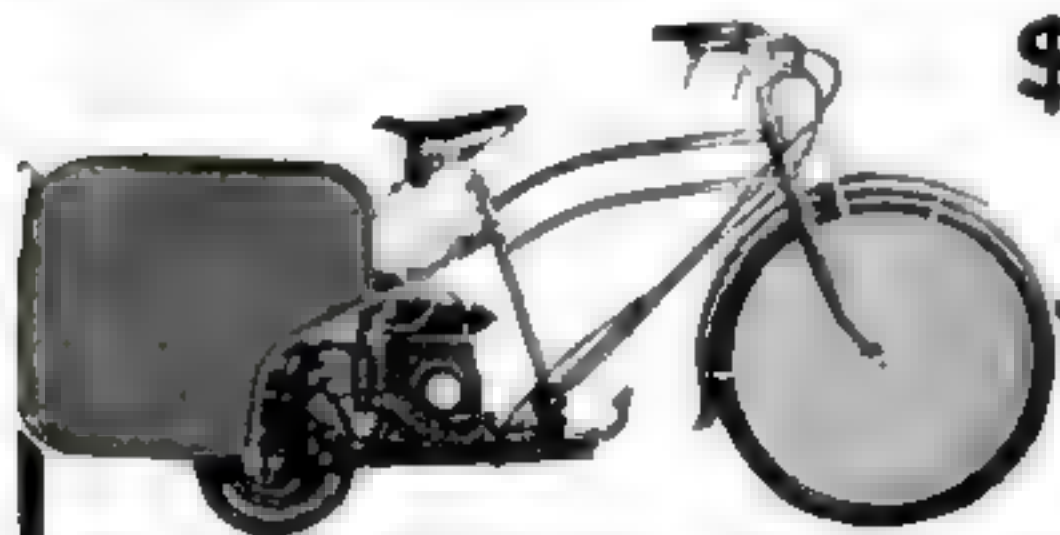
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A Bargain from Gus

(Continued from page 148)

once in a million years." He bent the gas line away from the filter line. "Look!" he said. "The gasoline has been pumping from the small hole in the tubing into another small hole in the return section of the filter line! Those two lines were tight against each other where they crossed. Copper is soft and the tubing thin, and friction wore a hole in each line. What made the leak hard to find was that the two lines were so tight together that they made a tight fit—hardly any of the gasoline spilled out to give a fellow a clue to the trouble. It just happened that I thought I smelled raw gas.

"That accounts for your oil-gauge trouble, too," Gus explained. "The raw gas thinned the oil so much that the oil pump couldn't handle it fast enough to build up any pressure."

"I'll be gosh-danged!" was all that Silas said.

Gus cut off the engine, replaced the leaky lines with new tubing, poured in six quarts of oil, started the engine again, and allowed it to idle.

"That's that," he told Silas. "Guess you didn't drive far enough to do any damage to your engine. Take a look at your oil gauge—it's working all right now. Well, while we let that new oil circulate a bit, let's go into the office and we'll fix up your bill for you."

Joe Clark took care of that little detail. When he handed the bad news across his desk to Silas Barnstable the old fellow looked at every item three times, added up the total twice, and found it considerably less than he had feared it would be. "That ain't so bad," he said at last, grudgingly. "But that odd thirty-five cents. . . . we'll jest cut that off, hey?"

"No, sir; we won't!" Joe told him. "That's our price—just exactly as it totals up there!"

The old man grunted, and wrote out a check in his crabbed hand. Then he went back to the shop and climbed into his car.

He backed it a few feet, then stopped and raced his engine. It ran smooth as cream. He saw Gus watching him, and his seamed face twisted into something like a smile. "This time," he said, "I guess mebbe I got a real bargain!"

New Wood Preservative

FREE from objectionable color and odor, a new preservative is said to be applicable to wood without altering its "feel" or appearance, and without affecting subsequent finishing. The makers claim that it protects wood against both decay and termites.



YOUR eyes are a vital link between your ability and the accuracy of the work you turn out. Insist on modern lighting at your machine or bench, and above all never do any wheel dressing or grinding without goggles.

When you discover misalignment between the headstock and the V-ways of your lathe, see that the machine is perfectly level before looking elsewhere for the trouble.

Weld splatters will not adhere to the screws of C-clamps used for clamping work while electric welding if they are protected with a coating of graphite and oil.

Don't attempt any welding on die castings, especially if they are of zinc alloys; the chances are 100 to 1 that you will find it a costly experiment.

So many new steels and alloys are being introduced that there is no such thing today as a standard clearance for milling cutters. The safest course is to be guided by filed records of a tested clearance for the particular operations to be performed.

As a safety precaution it is important that sand used in bending pipe should be absolutely dry before heat is applied. If rosin is used instead of sand, it should be allowed to harden thoroughly before proceeding.

When drilling stainless steel, use a high-speed steel drill of the shortest possible length. Give the lips plenty of clearance and stone the edges. Use half the speed recommended for mild steel. Apply ample coolant, cool the drill after each hole, and avoid punch marks with small drills.

Short Ends of Steel Stock Often Sold at Low Cost

AMATEUR machinists who live in the neighborhood of a steel warehouse can often obtain a variety of short ends of round, hexagonal, tubular, and eight-sided steel stock of certain grades for a fraction of the regular cost. Although steel wholesalers usually sell only to dealers and manufacturers, they will often let their short ends go to anyone who will haul away a few hundred pounds.—J. M.

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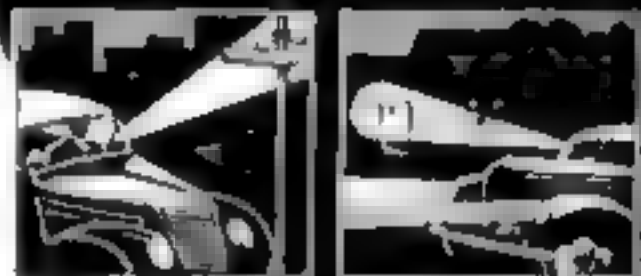
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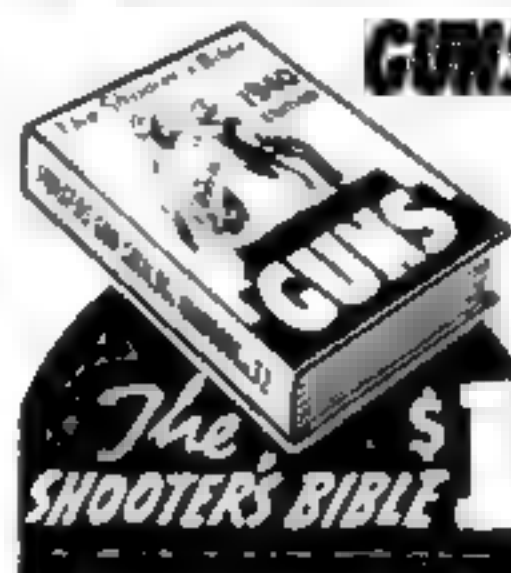


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Long Glued Work Wrapped with Heavy Rubber Band

WHEN suitable clamps are not available for difficult gluing jobs, such as gluing long laminated spars, a heavy rubber band cut from an old inner tube may be used. The band is cut in a continuous strip about 1" wide around the circumference of the tube. Rubber has an advantage over other binding materials in that there is very little tendency for the glue to stick to it.—R. J. HEINEN.

Push-Pull Switch Gives Safe Control of Saw

RECENTLY when the sleeve of my jacket became caught in a small circular saw, I was more than thankful to be able to shut off the power instantly by throwing the switch with my knee.

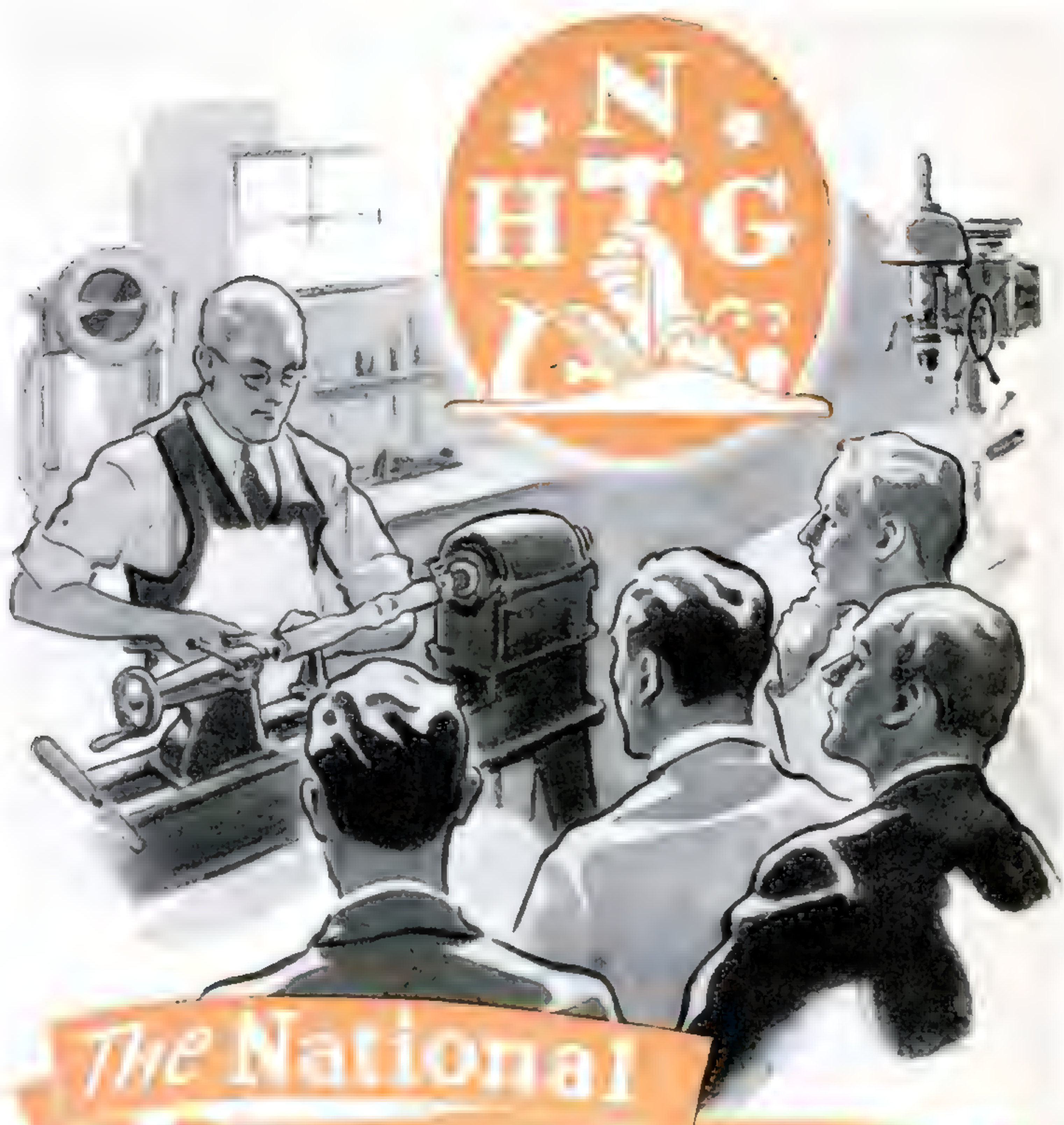
This was possible only because I had previously installed a push-pull switch on the left front leg of the saw table at a height level with my knee. A 110-volt switch of this type can be obtained from electrical dealers; I bought mine from a mail-order house for twenty-nine cents. Only a few minutes are required to install it, and it provides a very convenient way to control the motor when an emergency arises.—H. M.

Emery-Treated Leather Strop Gives Keen Edge to Tools

NO MATTER how keen an edge is obtained on a knife, plane iron, chisel, or other tool by using an oilstone or hone, it can be improved with a strop prepared as follows: Cut sole leather of the size desired, soak the fibrous side in water, scrape it to loosen the fibers, and sprinkle with emery dust. Shoe-polishing cream or lanolin is then spread on and mixed with more emery dust. Work this in until it presents a smooth surface, allow it to dry, and then dust on more emery to improve the cutting quality. Grain sizes as large as No. 240 give good results, but smaller sizes are to be preferred.—H. GRUBBS.

Drill Chuck Serves as Gauge

IF NO drill gauge is available and it is necessary to choose a drill the same size as a certain bolt or pin, the drill chuck will serve roughly as a gauge. Open it enough to admit the bolt or pin, then select a drill that will just fit into it.—S. J. G.



The National

Homeworkshop Guild

1939-1940 SEASON

**On the following pages is the amazing story of the world's
greatest organization of home workshop clubs . . . what it
plans to do . . . and how you can share in its activities**

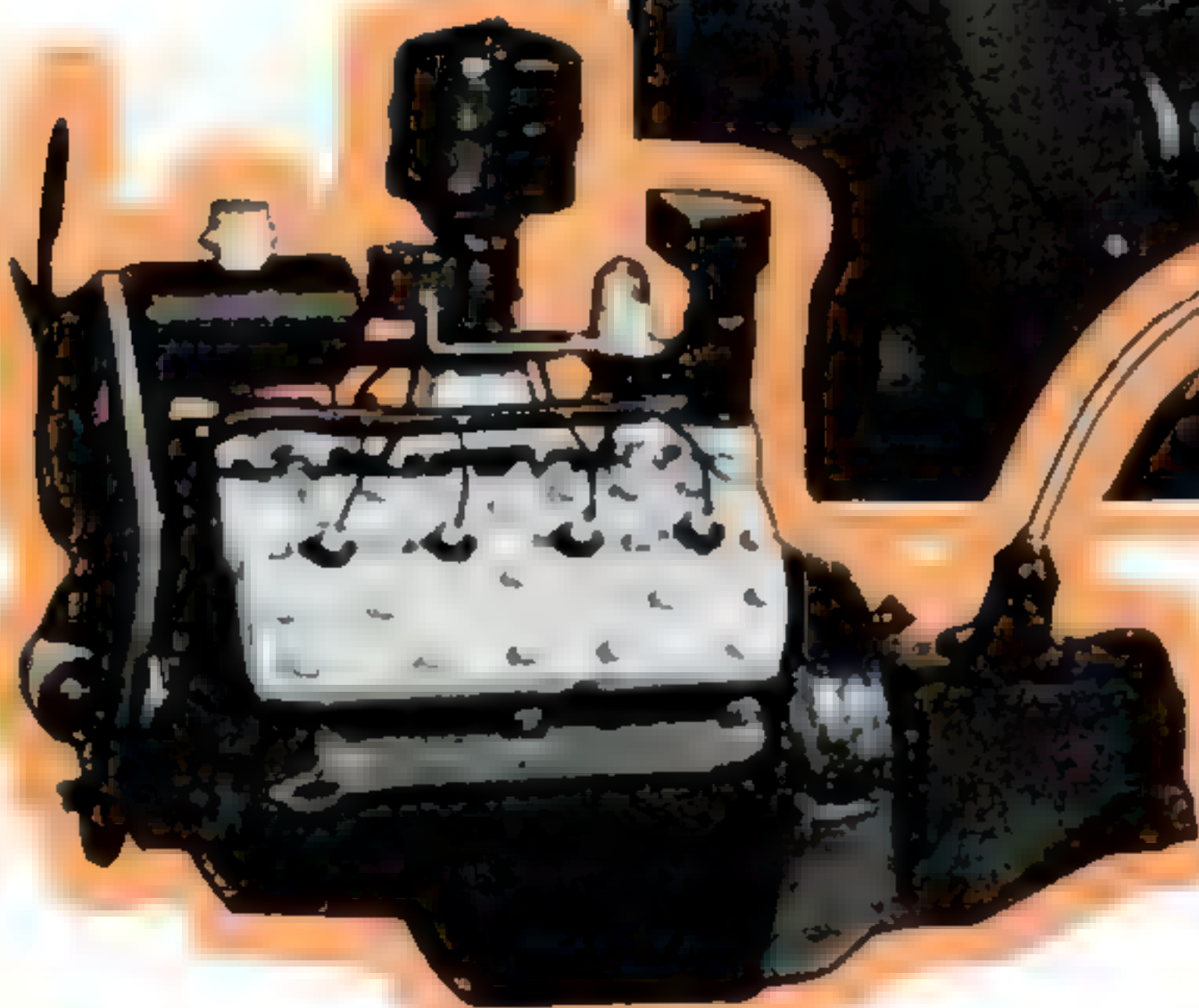




NATION-WIDE FATHER- New Season for

MOUNT VERNON
(N. Y.) Homecrafters
hold a father-and-son
night to watch a demon-
stration in the basement
shop of John Stevenson

AUTO ENGINE MODEL
made by Robert Geo-
ghegan, of New York. Al-
though it looks realistic,
all parts are formed of
cardboard except for a
few small pieces of wire



**1939-1940 Plans Include
Demonstrations of Tools
and Materials, Movies,
Exhibitions, Contests,
and Interclub Meetings**

A GROUP of men and boys gathered in a basement workshop several weeks ago to witness a demonstration of woodworking power tools. The men were the members of the *Mount Vernon (N.Y.) Homecrafters Club*, and the meeting was the first in a series of father-and-son nights to be sponsored by clubs affiliated with the *National Home-workshop Guild*.

In nearly 400 towns and cities throughout the United States and Canada this month, home workshop club members will bring their sons to meetings that have been especially arranged to interest the younger generation. These sessions are the opening gun in the 1939-1940 program schedule.

During the coming months the clubs will hold exhibitions, conduct contests, arrange demonstrations of home workshop equipment and supplies, show industrial movies, visit neighboring clubs, and in many similar

AND-SON NIGHTS START Home Workshop Clubs



DOLL HOUSE BUILT BY
George Hermann, presi-
dent of Mount Vernon club



LINCOLN (NEBR.) CLUB members,
who visited two home workshops and a
factory one night, are shown at right

ways help their members to enjoy their hobby, and at the same time stimulate interest among other men and women.

The Inland Homeworkshop Club of *Spokane, Wash.*, will cooperate with the Federal Art Center this fall to promote a city-wide craft show. Plans are also under way for a joint meeting of several clubs to be held in the miniature theatre of C. W. Talbot, president, who will entertain with magic.

R. E. Wade, manual training instructor, has been engaged by the *Alliance (Ohio)* Homeworkshop Club to give a series of demonstrations on the uses of hand and power tools. Several members are making their own power tools.

A moving picture about plywood, "Your Home Built in a Day," was shown to the Town Hall Homeworkshop Club, *Ottawa, Ill.* . . . The Bison Homeworkshop Guild, *Buffalo, N.Y.*, is issuing a monthly bulletin entitled "Shavings." The editors are Theodore Roberts and A. L. Flower . . . C. E. Lehman demonstrated wood finishing before the Gem City Homeworkshop Club, *Dayton, Ohio*. Fourteen members attended . . . Attendance at meetings of the South Shore Homeworkshop Club, *Quincy, Mass.*, has increased considerably since a revised schedule has been put into practice. Members work on their

MINIATURE CLOCKS
made by H. Hagen, of the
club in Cornwall, Ont.



projects from 7:30 to 10, refreshments follow, and business is discussed last.

Several hundred articles were displayed by the *Long Beach (Calif.)* Homecraftsman's Club at a four-day exhibition in the municipal auditorium. A total of 18,492 persons attended and saw the operation of various power tools by members.

John Randall demonstrated uses of the lathe and drill press recently for the *Farmington (N.H.)* Homecraft Guild. A commit-

tee was appointed to repair the town pump.

The *Midland (Pa.)* Homeworkshop Club, which was organized recently, reports that it is composed of three electricians, one welder, one painter, one structural draftsman, one pattern maker, three molders, one barber, and two laborers . . . Woodworking and French polishing on the lathe were demonstrated when the *Connellsville (Pa.)* Homeworkshop Club met at the home of the secretary, C. W. Syphax . . . The *Edmundston (N.B., Canada)* Hobbyists Club held its annual exhibition in the window of a drug store . . . A picnic for members and their families was sponsored by the *Galesburg (Ill.)* Homeworkshop Club before discontinuing meetings for the summer. Approximately seventy persons attended.

Two members of the *Ware (Mass.)* Craftsman Guild were recently honored for the services they have performed for the club. Joseph J. Babiasz was presented with a bill fold and "keytainer" for allowing the club to use his restaurant without charge as its headquarters. John J. Vertic, who made a large club banner, received a similar gift. An exhibition will be held this fall.

Industrial moving pictures will be shown at every other meeting this fall, the *Vicksburg (Miss.)* Homeworkshop

Club decided when it met at the shop of Sam Albrecht and Milton Levy. Plans for an extensive publicity campaign were discussed. The following session was held in the workshop of W. H. Rodgers who exhibited a 30" metal-working lathe and a large drill press he had designed and constructed.

Clubs located in the following towns and cities have become affiliated with the Guild in recent months: *Springfield, Ohio; Tacloban, Leyte, Philippine Islands; Lajas, Puerto Rico; Beaver, Okla.; Clinton, Mass.; Brooklyn, N.Y.; Kingston, N.H.; Spring Valley, Ill.; Austin, Minn.; Newark, N.J.; Alliance, Ohio; Chelsea, Mich.; Baltimore, Md.; Scituate, Mass.; Ecorse, Mich.; Lockwood, Mo.; Hammond, Ind.; and Midland, Pa.*



TWO OHIO CLUB EXHIBITIONS.

Above is a woodworking display by the Columbus Homecraft Club at the Central Ohio Hobby Show. At left is one corner of an exhibit by the Gem City Club of Dayton



TOYS FOR THE POOR. The Lexington, Ky., club constructed these playthings for mountain children

IN 1938 the affiliated clubs of the National Homeworkshop Guild made or repaired approximately 50,000 toys for poor children. The total was an all-time record, but the clubs were not satisfied. They hope to double that figure by this Christmas. The slogan for 1939 is "100,000 toys for 100,000 children."

When the Guild was organized six years ago, several clubs took an immediate interest in civic activities and soon began making or repairing toys. The idea spread rapidly and today tends to assume the proportions of a major home workshop industry. A tabulation of the toys made in 1938 reveals that each of twenty-one clubs made 250 or more, and together the twenty-one clubs were responsible for 16,837 toys.

The majority of the clubs wait until the fall season before starting the work. The methods used vary greatly. Sometimes each member works separately; sometimes the members work together to produce large quantities of the same design. Usually the toys are distributed through the Salvation Army, Red Cross, Boy Scouts, and similar

100,000 Toys for 100,000 Children

TOY-PROJECT HONOR ROLL

Listed below are the home workshop clubs that made or repaired 250 or more toys for poor children during 1938.

Bais Central Club, Philippine Islands	600
Billings (Mont.) Homeworkshop Club	500
Bison Builders Guild, Buffalo, N. Y.	400
Bison Homeworkshop Guild, Buffalo, N. Y.	1350
Cuyahoga Falls (Ohio) Club	1000
Danville (Ill.) Homeworkshop Club	300
Helena (Ark.) Homeworkshop Guild	500
Lewis-Clark Club, Lewiston, Idaho	1000
Lexington (Ky.) Homecrafters	500
Long Beach (Calif.) Club	4182
Louisville (Ky.) Homeworkshop Club	1000
Lynn (Mass.) Handicraft Club	2100
Moundbuilders Club, Newark, Ohio	300
North Shore Club, Waukegan, Ill.	1000
Orange (N. J.) Homecraftmen Club	500
Passaic County Club, Hawthorne, N. J.	255
Portland (Ore.) Homeworkshop Club	300
San Diego (Calif.) Homecraft Club	300
Siege Homeworkshop Club, N. Y. C.	250
Union County Guild, Elizabeth, N. J.	250
Walla Walla (Wash.) Club	250

organizations, but there are occasions when the members do all the work. The Bison Homeworkshop Guild of Buffalo, N. Y., which recently won a silver plaque for its project last Christmas, is an excellent example (see P.S.M., Sept. '39, p. 177).

A committee appointed by the Saginaw (Mich.) Homecraft Club visited three local children's homes during the summer and compiled a list of the toys that would be most acceptable. "In this manner we feel that we will be more pleased with the results than distributing them through some agency," Secretary L. E. Foglesong reports. "We expect to make large toys of the playground type which will last the entire year." Pro-



COMPLETING A DUCK PROJECT

The Moundbuilders Workshop Club of Newark, Ohio, used mass production methods to make the toy wagons shown above



LEWIS-CLARK HOMEWORKSHOP CLUB with some of the toys they turned over to the Welfare League, of Lewiston, Idaho. Left, Charles H. Hunt, of the Long Beach, Calif., club puts the finishing touches on a novelty



duction will begin as soon as meetings are resumed late this month.

The Long Beach (Calif.) Homecraftsman's Club turns its toys over to a local newspaper for distribution. Last year 4,182 toys were made and the members hope to go way past the 5,000 mark this year.

Parke Soule, of the Ashland (Ohio) Homeworkshop Club, has designed a bed tray. It

will be made in quantities and given to the local Samaritan Hospital and Children's Home. Toys will be made also.

Fifty toy wagons were made last year by the Vicksburg (Miss.) Homeworkshop Club and work has already started on this year's quota of over one hundred. They will be distributed by the Elks Club and several church charity groups.

Merchants of Gadsden, Ala., have donated wood which the Nocalula Homeworkshop Club will use to make toy furniture.

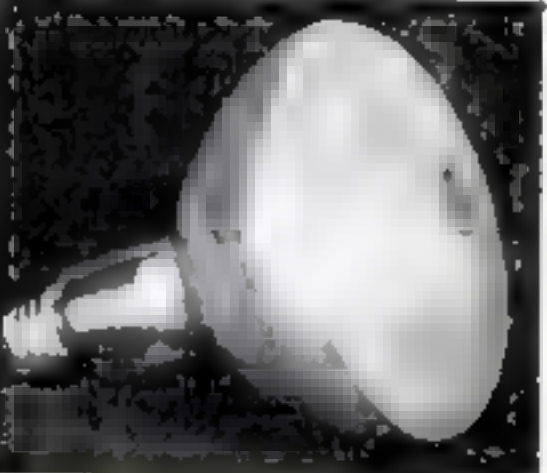
It costs nothing to join the Guild. Full particulars on how to start a club will be sent upon receipt of a large, self-addressed, stamped envelope. Address National Homeworkshop Guild, 347 Fourth Ave., New York.



FATHER AND SON have lots of fun in light like this! Bulbs used here cost only 20c apiece. They're 150 watt G-E MAZDA lamps in standard RLM dome reflectors.

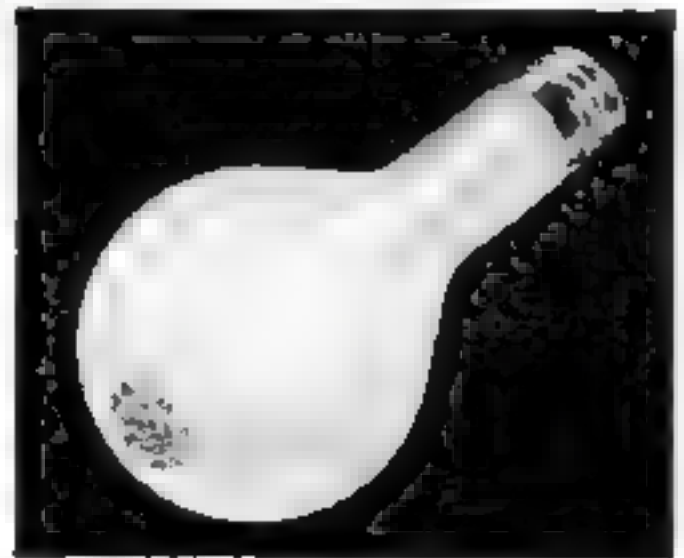


NEWEST workshop lighting idea is the G-E MAZDA Reflector Lamp. A bulb and spotlight in one, it's ideal for extra light on jigsaw or drill press.



G-E MAZDA Reflector lamp (left). Spotlight throws intense downbeam on fussy jobs, yet silvered sides protect the eyes, 150 watt, 95 cents.

EVERY YEAR G-E research and development makes G-E MAZDA lamps give more light for current consumed. **THEY STAY BRIGHTER LONGER IF THEY'RE MARKED**  



HOW TO LIGHT YOUR HOME WORKSHOP

OF all the tools a man can have in his workshop, good light is perhaps the most important. You can't work well or fast without it! The question is, what is good light? Standard for workshop lighting is still the RLM dome reflector, like the two shown above, with 150 watt inside frosted G-E MAZDA lamps. Something new and different, is the new G-E MAZDA Reflector Lamp. A MAZDA lamp and reflector in one, it's perfect for downlight on difficult jobs. Whatever type you use, it pays to get G-E MAZDA lamps. They give more light for the money because they *stay brighter longer!*

G-E MAZDA LAMPS GENERAL ELECTRIC

Send for FREE Light Conditioning Wheel!



General Electric Co., Dept. PS-J, Nela Park, Cleveland, Ohio.

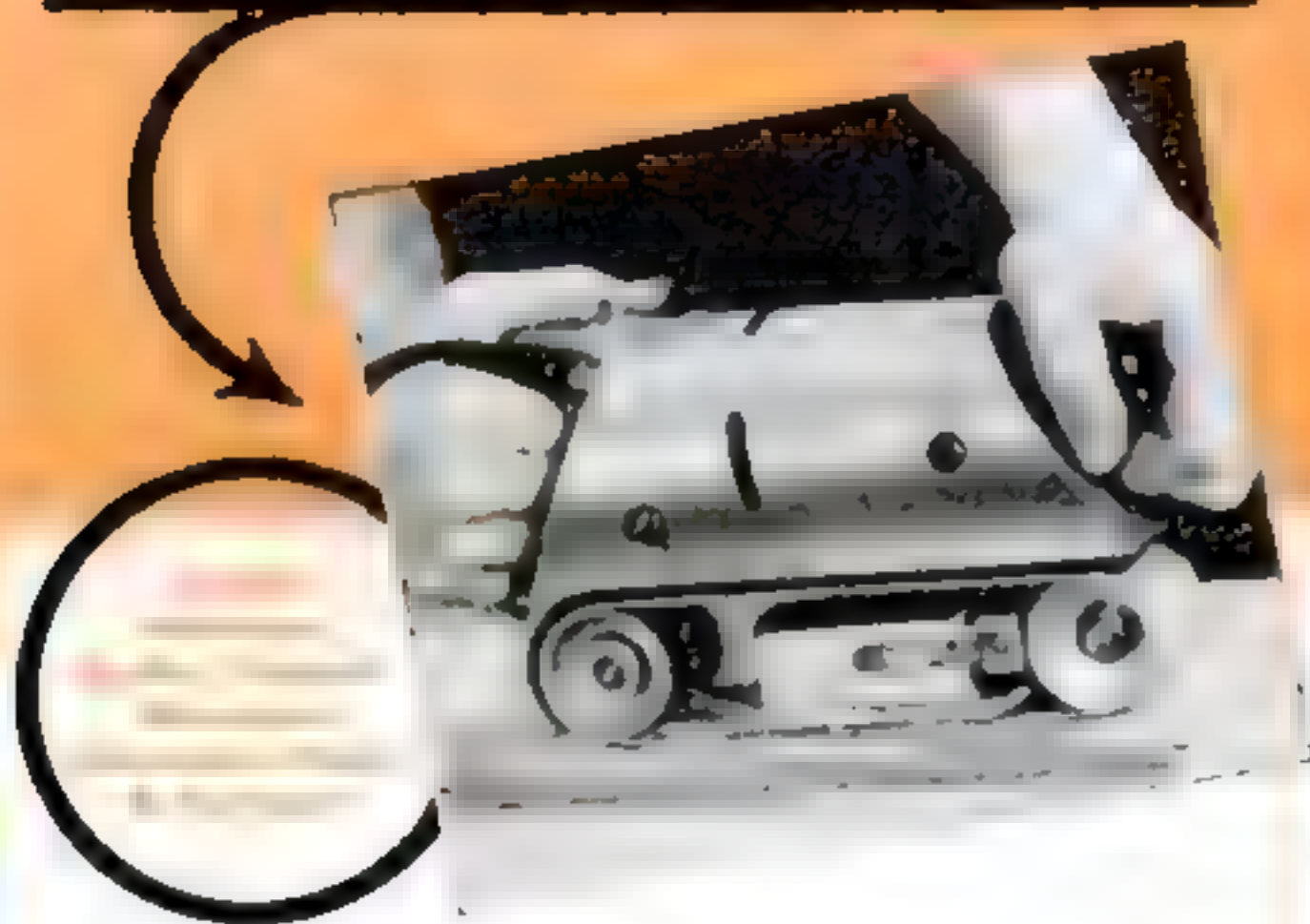
Please send me free your interesting new "Light Conditioning Wheel" that shows how to get better light in any lamp or fixture.

Name

Address

City State

Get those **TEDIOUS JOBS**
of **SANDING** done
The Quick, Easy Way!



New Guild PORTABLE ELECTRIC **SANDER**

Now you can turn those tedious, tough hand-sanding and scraping jobs into pleasure and profit all the way through, and *ten times faster!*

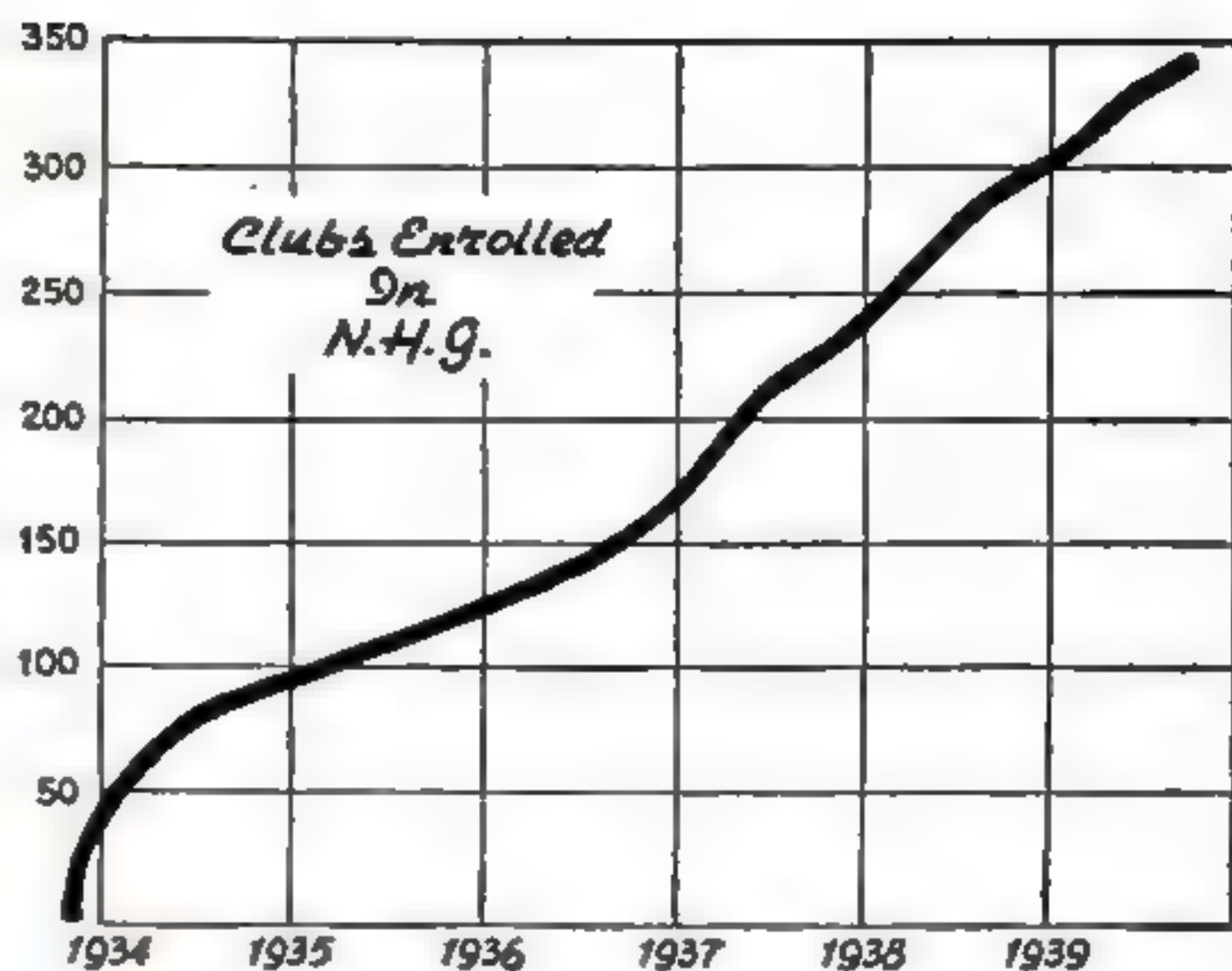
This New GuildSANDER weighs only 9 pounds . . . plugs into the nearest light socket . . . both AC and DC . . . has powerful universal motor . . . can be operated by *anyone*. Works on wood, metal, wall-board, plastics, glass, marble, and compositions. The GuildSANDER is fully guaranteed!

Try this New GuildSANDER on *your own work!* Then you'll discover why thousands of users say it's the best tool investment they've ever made. See how much *finer* finish you get . . . how much *time* it saves . . . how many different *jobs* it can do—in your home shop, around the house, in many production operations.

The GuildSANDER . . . popularly priced . . . is built by famous sanding-machine craftsmen. Does the quality of work of sanding machines costing double the money. Continuous sanding belt gives a straight-grain finish . . . no cross-grain roughness. Mitres and joints sanded to a smooth, tight fit. It's the **QUICK** way to take off paint and varnish—no messy removers.

FIND OUT for yourself now how this New GuildSANDER will *help you on your work!* **SEE IT** at your hardware or mill-supply dealers'. Or **WRITE US TODAY** for full details.

SYRACUSE GUILD TOOL CO.
1700-10B N. SALINA ST.
SYRACUSE NEW YORK



Guild's Growth Registers Steady Upward Curve

WHEN the National Homeworkshop Guild was organized six years ago, the directors foresaw little of the tremendous progress that has taken place. Craftsmen everywhere immediately realized the advantages of banding together in home workshop clubs so they could exchange ideas and arrange demonstrations and lectures to help them improve their work.

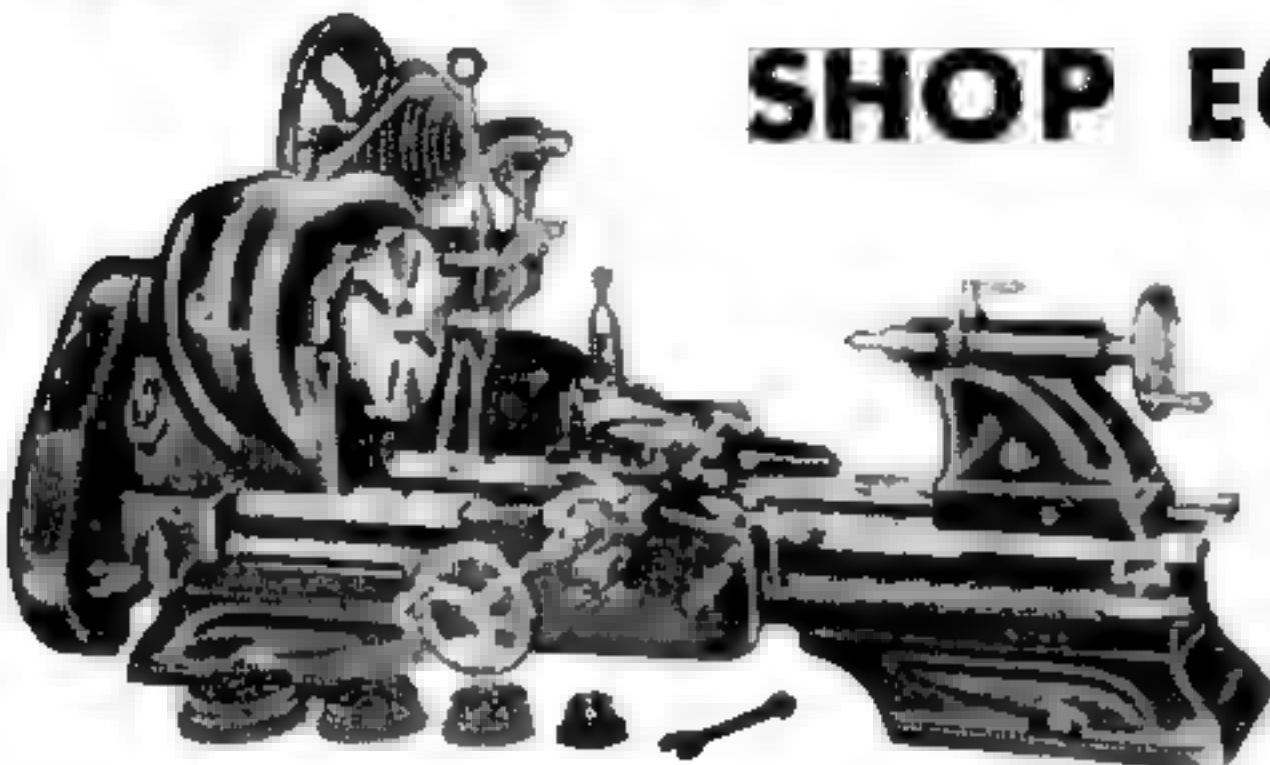
The number of clubs affiliated with the Guild increases monthly. At present there are 308 clubs distributed among 40 states, 30 more in Canada, 2 in the Philippine Islands, 1 in Hawaii, and 2 in Puerto Rico, a total of 343 clubs.

What is the typical club member like? Surveys conducted by the Guild show that he is 32 years old and may follow almost any vocation under the sun, from bank president to laborer. The five leading occupations in order of their frequencies are salesman, electrician, clerk, teacher, and mechanic. His education is better than average: it is almost a one-to-two chance that he went to college and a one-to-four chance that he holds a college degree. The member spends nearly twelve hours a week in his shop, which is usually located in the basement and can be lighted and heated. His equipment consists of five machines and fifty hand tools in which he has invested approximately \$190. He spends \$128 a year for wood, tools, hardware, paint, metal, and miscellaneous supplies. He maintains his shop principally for enjoyment, but partly for making repairs and other profitable work. He devotes some of his time to making toys to be given to poor children at Christmas. **POPULAR SCIENCE MONTHLY** is his favorite magazine.

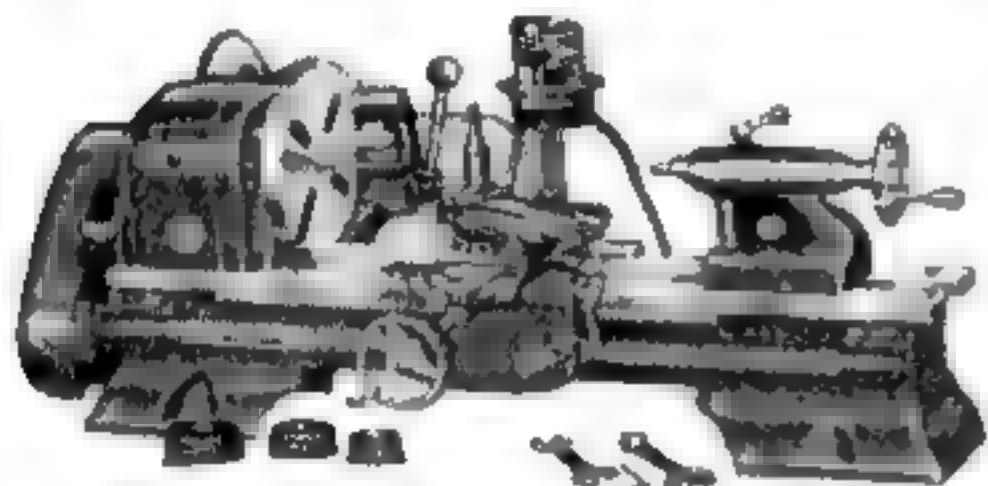
(Continued on page 250)

Atlas

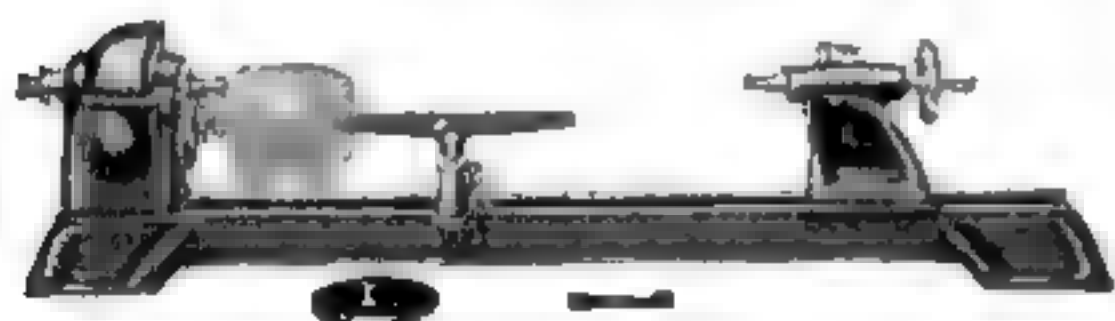
SHOP EQUIPMENT for 1940



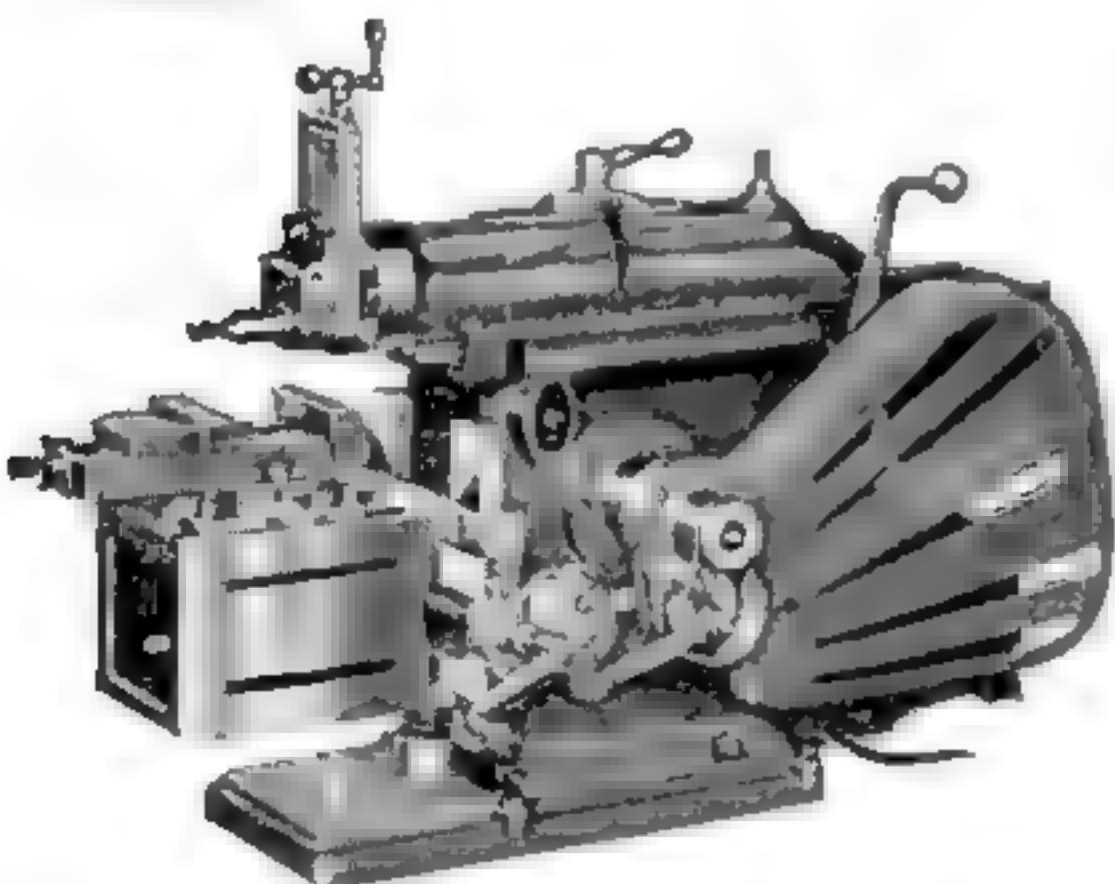
NEW ATLAS F-SERIES 10" LATHES have power cross feed as standard equipment and many other exclusive modern features.



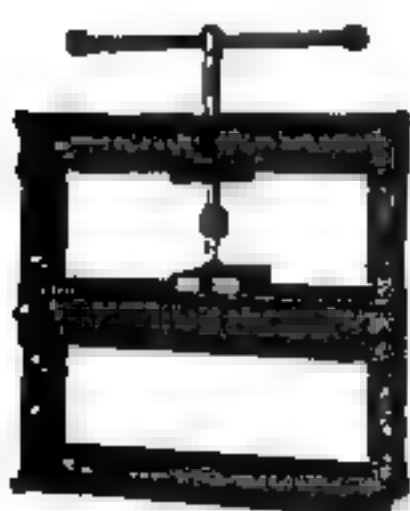
ATLAS 6" LATHES give you all the precision and power of larger models built down to scale for work on small parts.



Large deep-grooved SKF ball bearings give ATLAS WOOD LATHES unusual lasting accuracy.



This ATLAS SHAPER with 7" stroke is the first practical low-priced metal shaper.



Keep your drills sharp with this precision DRILL GRINDING ATTACHMENT.



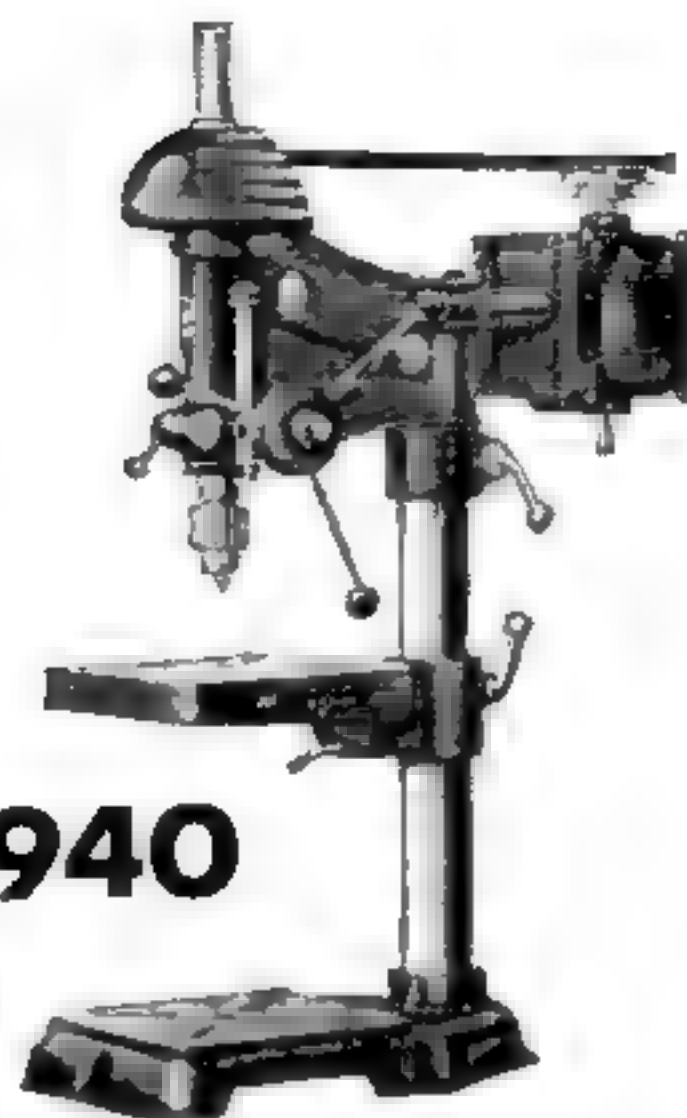
ATLAS ARBOR PRESSES handle pressures from $\frac{1}{2}$ to 70 tons.

The 1940 Atlas Catalog will be ready for you this month—72 pages crammed full of interesting machine operations, equipment close-ups, shop views, construction details, new and helpful machinery facts! Use the coupon below to reserve your copy now.

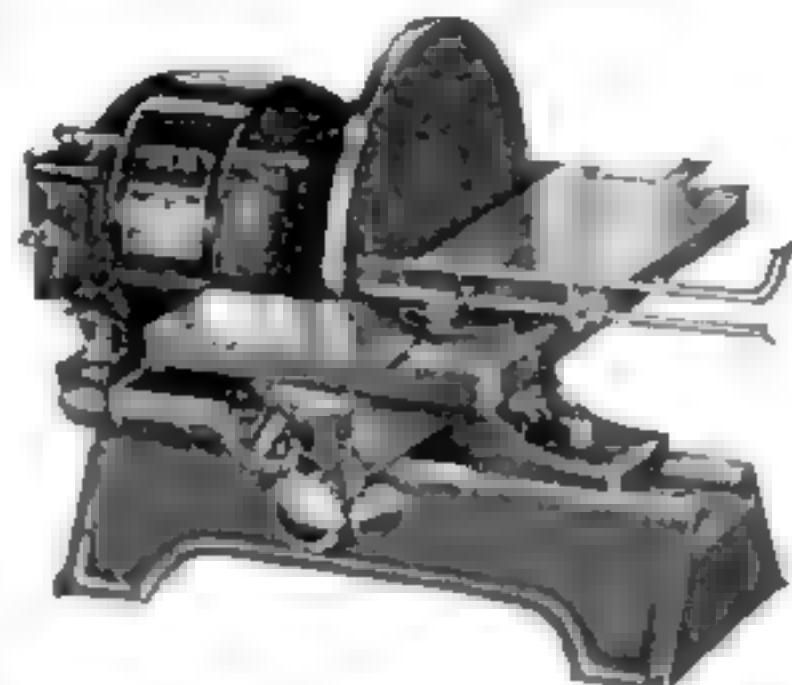
Every shop man should have this big new book at hand for quick reference during the busy months ahead. And we want you to note in particular the new developments of our Engineering Staff that make Atlas Equipment ever better and better for your use.

Fill out and mail the coupon today. There's a real treat in store for you. *Atlas Press Company, Kalamazoo, Michigan.*

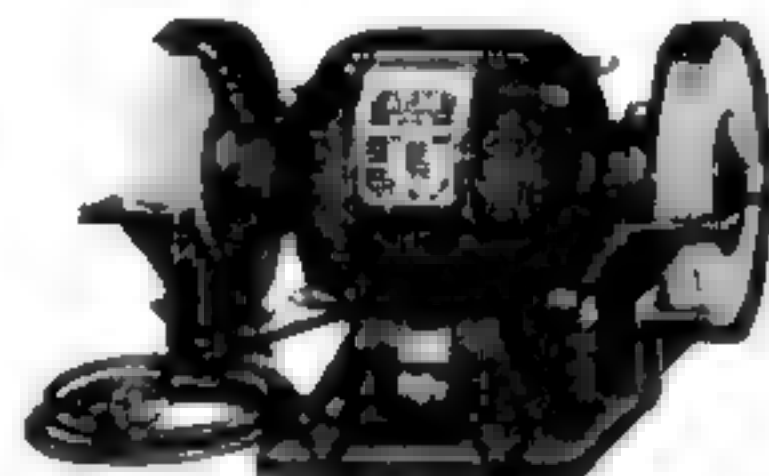
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1940
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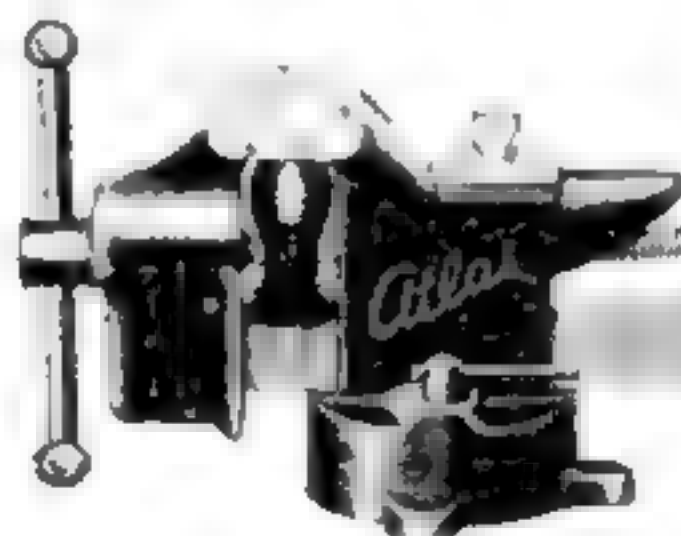
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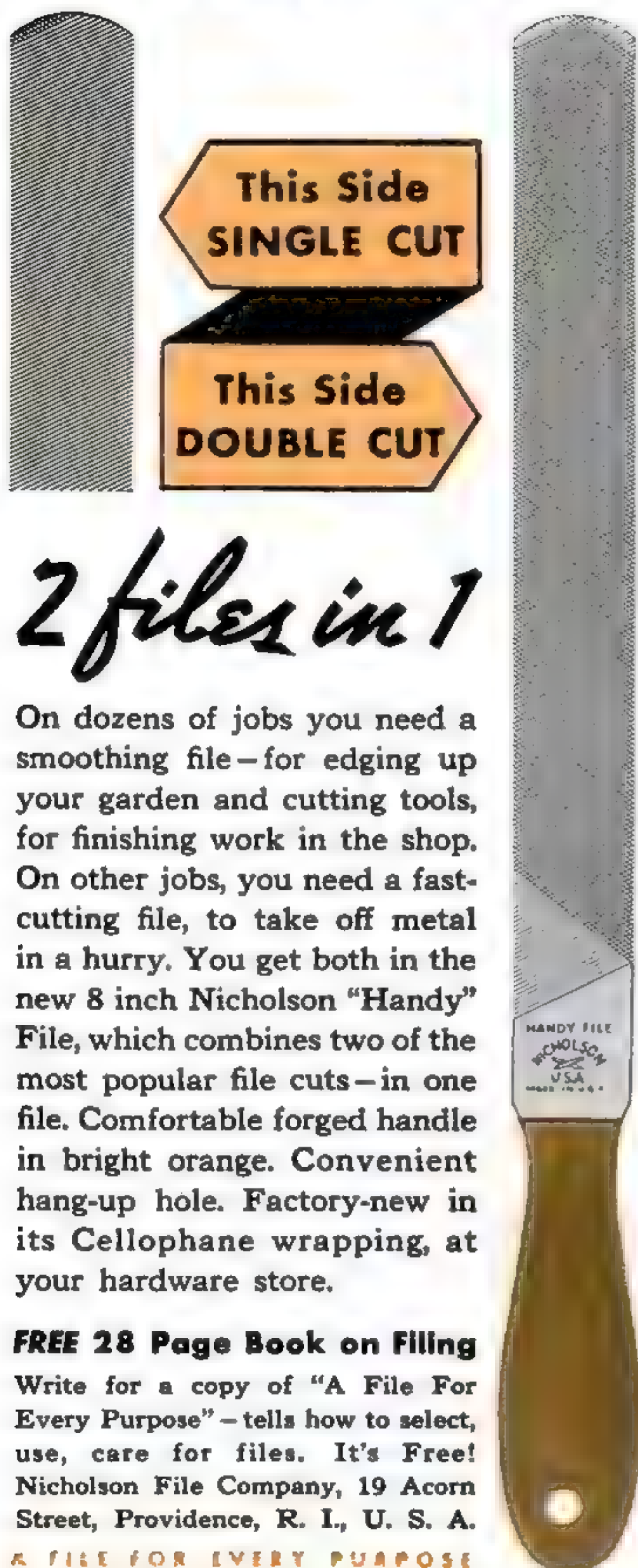
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**This Side
SINGLE CUT**

**This Side
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2 files in 1

On dozens of jobs you need a smoothing file—for edging up your garden and cutting tools, for finishing work in the shop. On other jobs, you need a fast-cutting file, to take off metal in a hurry. You get both in the new 8 inch Nicholson "Handy" File, which combines two of the most popular file cuts—in one file. Comfortable forged handle in bright orange. Convenient hang-up hole. Factory-new in its Cellophane wrapping, at your hardware store.

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NICHOLSON
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**75th
ANNIVERSARY
YEAR**

How the Guild Has Grown

(Continued from page 248)

As for the club itself, the surveys show that meetings are held more than once a month. The members usually meet at each other's homes, although one club in every four now has its own clubroom and workshop. A library of home workshop books and magazines is maintained at some place convenient to all. At least one exhibition is held each year. The local dues are \$1.80 a year, not including the clubs (21 percent) which charge no dues. There are no national dues. Assistance is provided by local hardware stores, which arrange demonstrations, distribute literature, sponsor meetings, donate space for exhibitions, and provide other services. The club is interested in civic activities and makes or repairs more than 140 toys a year to give to poor children.

Because of the assistance the Guild receives from its official magazine, POPULAR SCIENCE MONTHLY, it is able to provide many services for the affiliated clubs, all without



Distribution of home workshop clubs throughout the United States. There are 308 clubs in 40 states

any charge whatsoever. When a new club is chartered, it receives annual affiliate cards for the members and a copy of "A Manual for Home Workshop Clubs." Thereafter, the club secretary receives monthly bulletins and job sheets. The bulletins contain the latest news about Guild plans, book reviews, listings of new manufacturers' booklets and catalogues, program suggestions, and a variety of helpful ideas.

As part of its promotion campaign to encourage the organizing of home workshop clubs, the Guild sends out thousands of bulletins each year to persons who express an interest in the idea. In 1938 a total of 1,348 bulletins were mailed, while the figure for the first half of this year is 910. Each year the total is higher, indicating how interest is increasing.

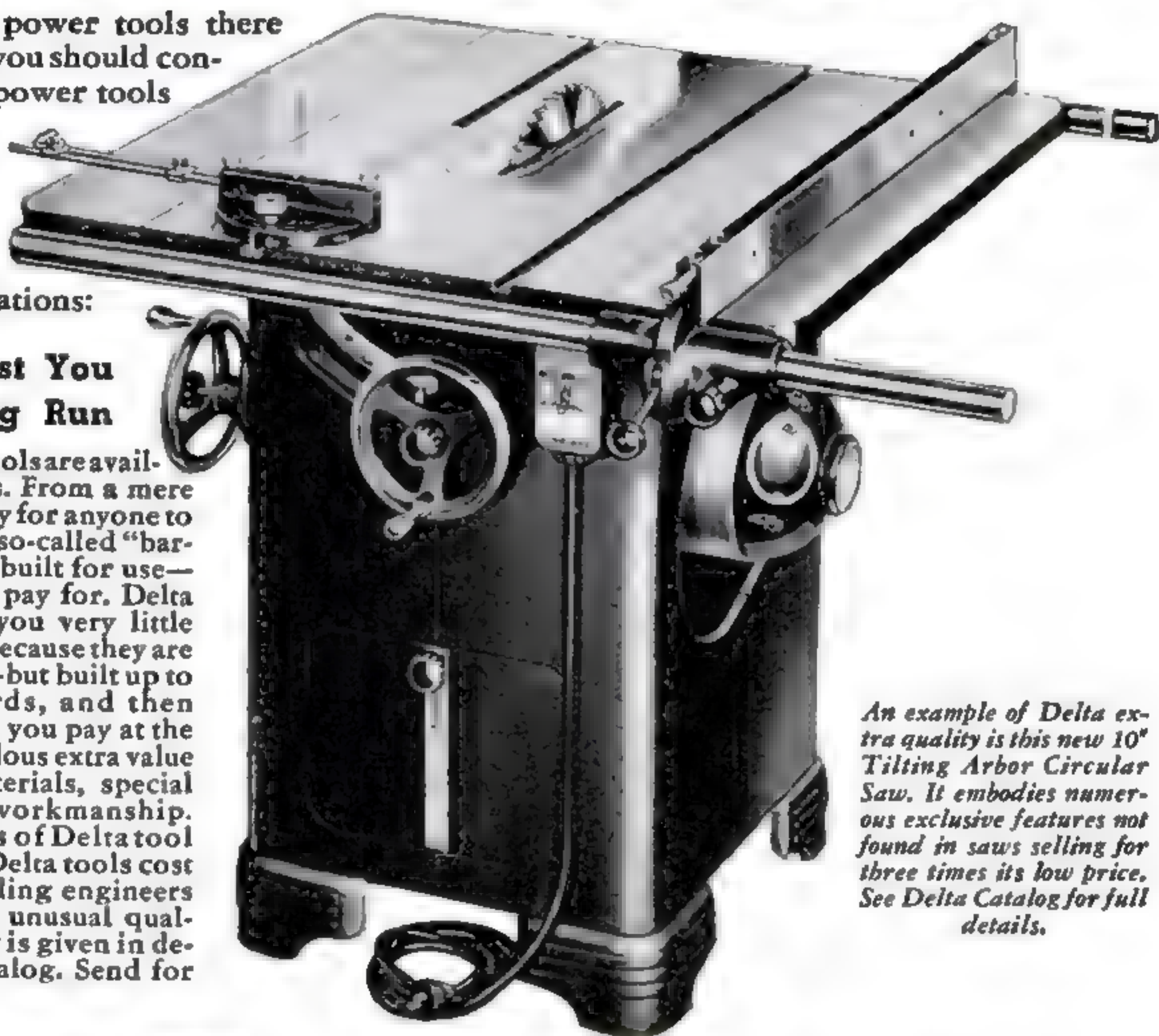
Important Facts about POWER TOOLS

Before you buy ANY power tools there are important facts that you should consider. When you select power tools for your shop, you are purchasing equipment for many years of use, not for today alone. In making your decision here are some vital considerations:

Quality Tools Cost You Least in the Long Run

Today, low-cost power tools are available at several price levels. From a mere price point of view it is easy for anyone to purchase "cheap tools" at so-called "bargain prices." But in tools built for use—you get exactly what you pay for. Delta tools, for instance, cost you very little more than ordinary tools because they are not built down to a price—but built up to unusual quality standards, and then priced. But that little extra you pay at the outset represents a tremendous extra value in design, quality of materials, special features, accuracy, and workmanship.

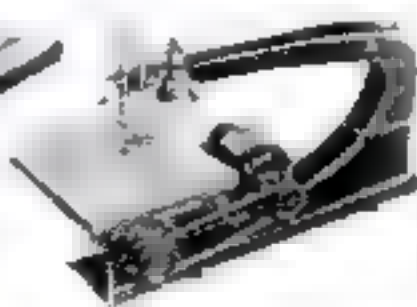
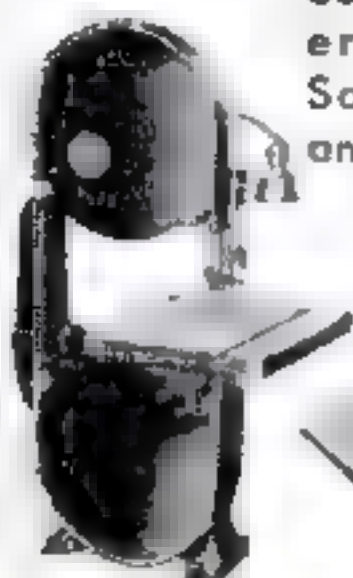
Hundreds of thousands of Delta tool owners have learned that Delta tools cost least in the long run. Leading engineers have marvelled at Delta's unusual quality. The full technical story is given in detail in the latest Delta Catalog. Send for your copy today!



An example of Delta extra quality is this new 10" Tilting Arbor Circular Saw. It embodies numerous exclusive features not found in saws selling for three times its low price. See Delta Catalog for full details.

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Send me the latest new 1940 Delta Catalog and list of Delta Dealers nearest me. ☐ I enclose 10c (stamps or coin) for which please send me the new Delta Project Book No. 6.

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return a nice
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It's a cinch to make money on your investment in Driver Power Tools. All around you are folks who want things made . . . who'll be glad to pay for the furniture, knickknacks, etc. you enjoy making. Try it! Driver Tools will prepare you for BUSINESS . . . enable you to turn out "professional" work that SELLS. Enable you to do it so easily that your "Business" will remain FUN for you.

YOU'LL WANT THIS GREAT 14" BAND SAW

It's as slick in operation as it is in looks. Does a multitude of jobs. Example is the corner cupboard shown above. Its keen blade, travels at 2535 feet per minute; zips through heavy oak as easily as a light panel. Rips, cross-cuts, makes accurate curved, angle and mitre cuts. Has a big 16"x16" tilting table and many other features. Built so well that big wood-working plants are using it. Costs little to own.



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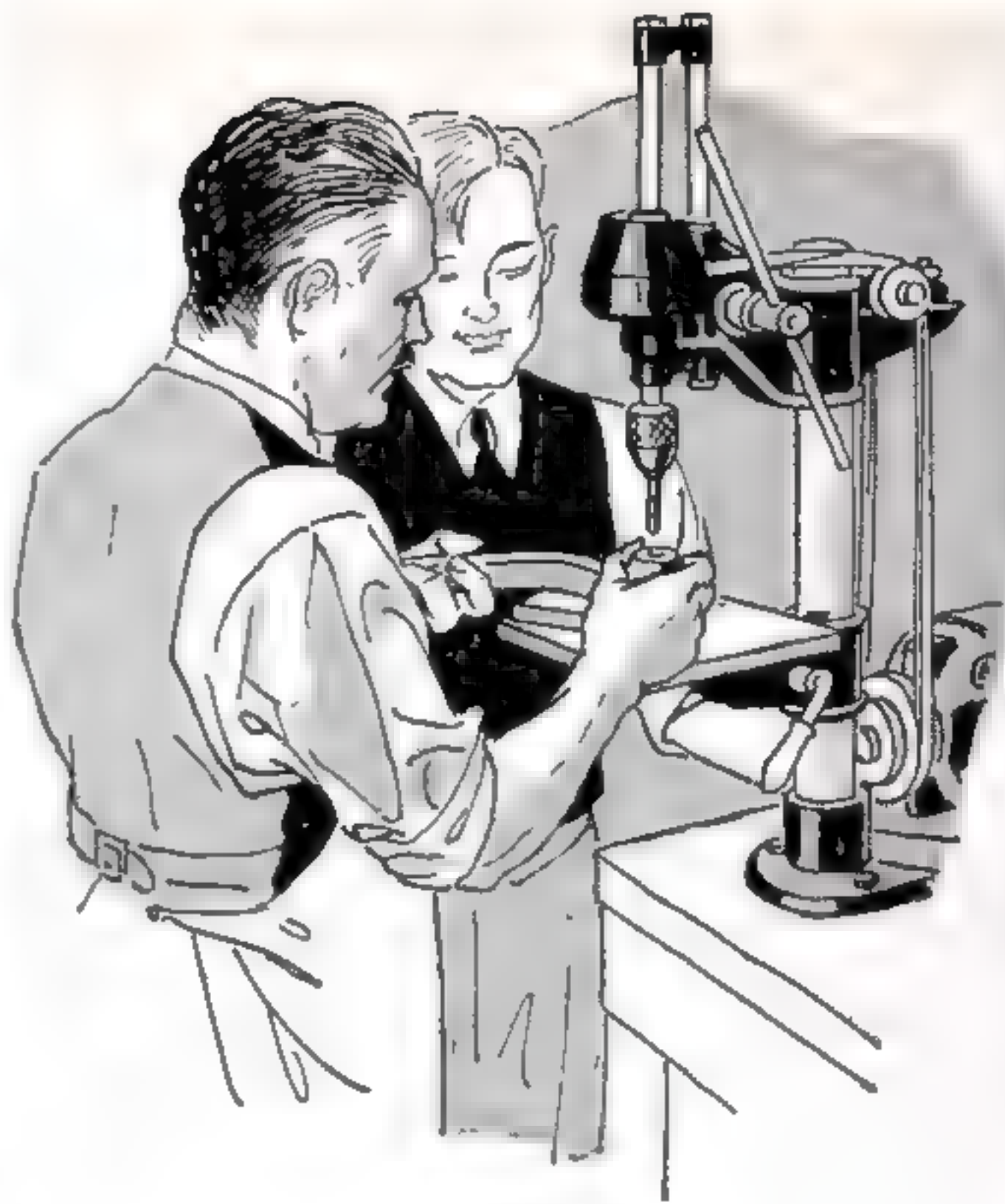
DRIVER *Engineered* POWER TOOLS

Walker-Turner Co., Inc.
2109 South Ave., Plainfield, N. J.

I want your Catalog of Driver Tools, accessories and motors.

Name.....

Address.....



Amazing Increase in Use of Power Tools at Home Shown by Guild Survey

FIFTEEN years ago very few amateur craftsmen owned power tools. Such tools were too expensive for the average pocket-book, so the home workshop enthusiast had to be content with hand tools. The tremendous strides in recent years made by manufacturers in bringing prices down within the reach of all, however, have greatly altered the situation.

A survey just completed by the National Homeworkshop Guild reveals that 65 percent of the members of its affiliated clubs own power tools. Those having workshops—not just a few tools kept in a box or a closet—amount to 73 percent. This means that of those having actual shops, 89 percent own power tools. The majority of the members own approximately five machines each. One quarter of the clubs have club shops, and each is usually equipped with at least three power tools.

The survey also shows that 85.7 percent of the members live in private homes, 14.3 percent in apartments. Many stated that even in the cramped quarters of a city apartment they had managed to set up small workshops. Tools in such shops are usually limited to small machinery of the type used by model makers, or consist of a power jig saw and an assortment of hand tools.

101 HOME CRAFTS-MEN

SENSATIONAL NEW Flexible SHAFT TOOL!

EASY TO HOLD—EASY TO USE

Here's new skill, new ease for home craftsmen! **FOREDOM** Tools afford complete freedom of operation—definitely controlled power at your finger tips. You can work in hard-to-reach places with professional precision. See illustration. Motor suspends from swinging wall bracket. You hold pencil-size, lightweight handpiece which can be grasped close to its end for easy control. Accessories interchange almost instantly. Hundreds of uses: grinding, polishing, drilling, milling, engraving, sharpening, slotting, stone-setting, rust-removing, sawing, carving, cleaning, sanding, scratch-brushing, etc., etc. Since 1922 **FOREDOM TOOLS** have been quality tested and proven by thousands of expert craftsmen the world over. Here's what you get: 1. High grade universal motor (operating on both AC and DC). 2. Flexible shaft assembly. 3. Handpiece as described. 4. 50-piece accessory set. 5. Swinging wall bracket—all for \$14.95, postpaid.

35 PIECE ACCESSORY SET FOR MOTOR TOOLS AND FLEXIBLE SHAFT TOOLS. OUTSTANDING VALUE, mandrels, brushes, stones, buff, sanders, etc., boxed for convenient use. Sent postpaid anywhere in U. S. 60c

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Order this Model 45 **FOREDOM** Flexible Shaft Workshop today. Enclose check or M.O. for \$14.95; or, if you prefer, we'll ship C. O. D. Try it for 10 days. If not completely satisfied, return the set and we'll refund your money at once. Catalog of this and other **FOREDOM** Tools free.

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DEALERS: Write for our special offer.

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MOTOR
FLEXIBLE SHAFT
PENCIL SIZE HAND-PIECE
USES 300 ACCESSORIES

Low Stain WATER RESISTANT GLUE

Airplane Model Makers! Wood workers! Hobbyists! Use this low stain, water resistant, proven Casein Glue—Laux 771-D. Quick! Safe on delicate woods. No high pressure clamping. Made by world's largest manufacturers of water resistant glue. Economical—1 lb. 65¢ prepaid anywhere in U. S.

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WORLD'S BEST LINE OF TRAILER AXLES, HITCHES AND PARTS

Complete house trailer working blue prints only 50c. WRITE TODAY FOR THIS NEW FREE CATALOG.

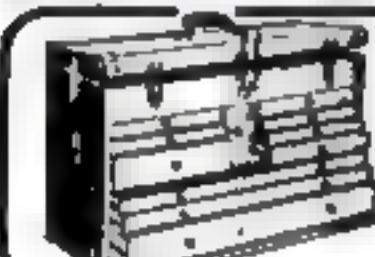
HAMMER BLOW TOOL COMPANY, Dept. D-18, Wausau, Wis.



TOOL CHESTS OF QUALITY

for toolmakers and machinists.
Free Catalog

HERSTNER TOOL CHESTS
539 Columbia St. Dayton, Ohio




NEW Grinding Attachment

For 8" to 16" Metal Lathes. Build It Yourself.

At last, a precision grinder within your means. You save 2/3 by finishing our semi-machined castings, on your own lathe. **HURON** handles both internal and external grinding. Accuracies to .00025". Mirror finish easily obtained. Grinds valves, pistons, bushings, shafts, hard or soft, holes, lathe centers. Sharpens reamers, milling cutters. Does eccentric drilling; taps; polishes; scores of other uses, for home workshops, garages, machine shops. Write for **FREE** illustrated folder and full information.

Huron Machine & Tool Co., Dept. C-10, Yale, Mich. Only \$5.95



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Send for our free plan on how to make \$5.00 to \$15.00 a week in your spare time by taking orders for the **NEW POPULAR SCIENCE MONTHLY** from your friends. No selling required. Turn extra hours into extra dollars.

POPULAR SCIENCE MONTHLY
353 Fourth Ave. Dept. 109 New York, N. Y.

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The Simple Sensible Red-I-Kut way as thousands have—**SAVE HALF**. **DIME** brings PLANS and sixty picture "HOW" Book written by our engineer pricing many fine brass weight Westminster, tube chime, electric movements showing nine beautiful colonial grandfather cases.

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FAMOUS STAR "EDGES UP" with CARBORUNDUM

Warren William praises Carborundum Brand Abrasive Products



THIS view shows cinemactor Warren William in his superbly equipped home workshop where he spends many happy hours of pleasant relaxation. Like most home craftsmen, Mr. William has found that the pleasure of making things in his shop is greatly increased if his equipment is kept in first class condition. That is why he has joined thousands of other fans in turning to Carborundum Brand Abrasive Products to keep all his edged tools sharp and keen. Read what he has to say:

"I would like home workshopers everywhere to realize that it's mighty important to keep tools sharp. Out here in my own workshop at Encino many a half-perfect job becomes perfect because I took two minutes' time out for edging up my tools on the job. And when I say sharpen, I mean Carborundum. That's the kind I use and recommend... Carborundum Brand Products for the craftsman."

If you, too, want to keep your edged tools in tip-top shape... if you want to make your work easier... ask your dealer for the famous Carborundum Brand Grinding Wheels and Sharpening Stones.



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In poor light or good light—the sharp *black-on-white* markings on this improved steel tape are always easy to read. You have less chance for error. The smooth white surface is crack-proof; easy to clean; bonded to the steel; protects it from rust. This tape is hard to kink, hard to curl; good for a long useful life. 25, 50, 75, 100 ft. lengths. Mail the coupon today for a free sample of the tape and an illustrated folder.

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LOOK FOR THIS DISPLAY 

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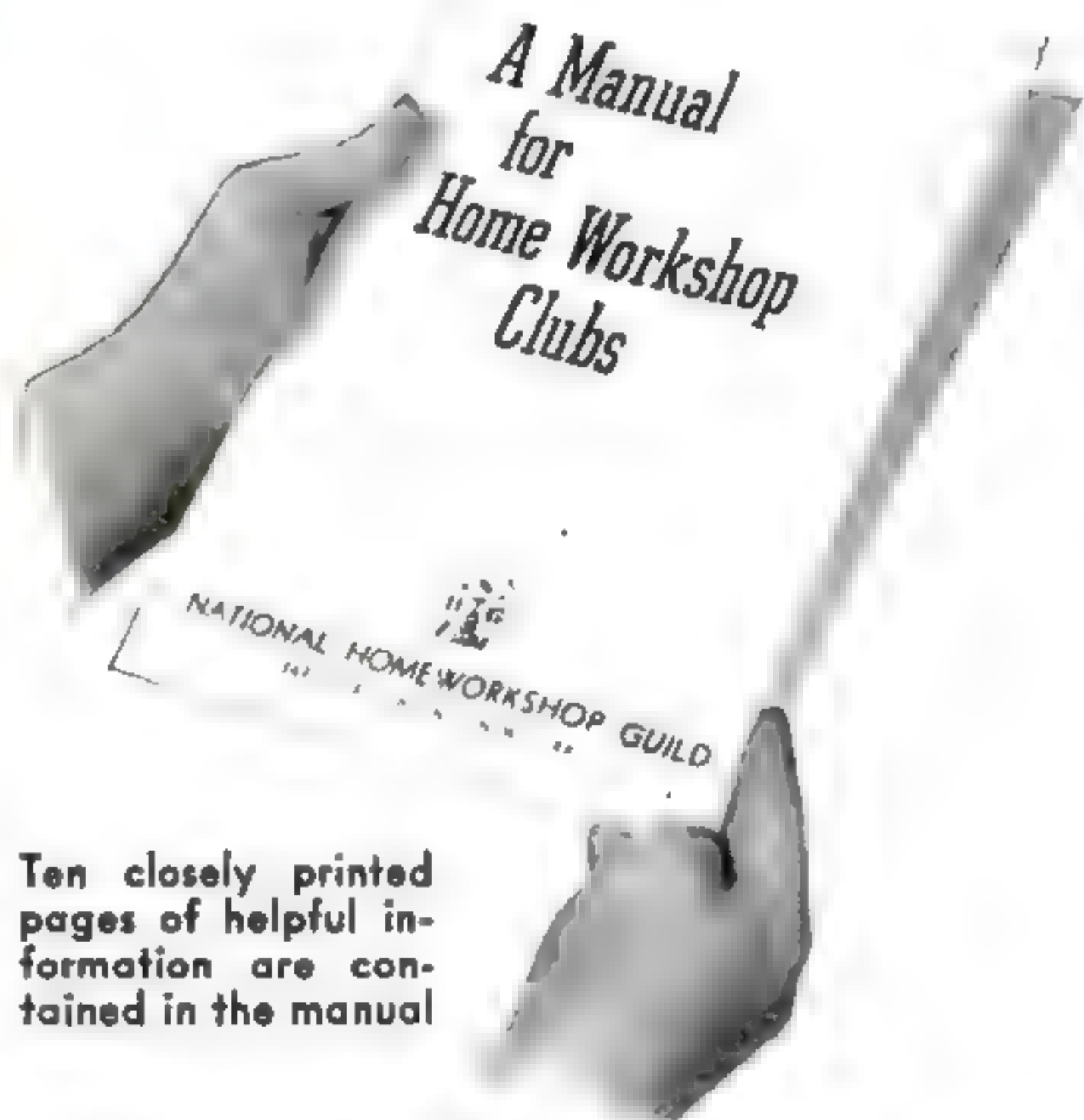
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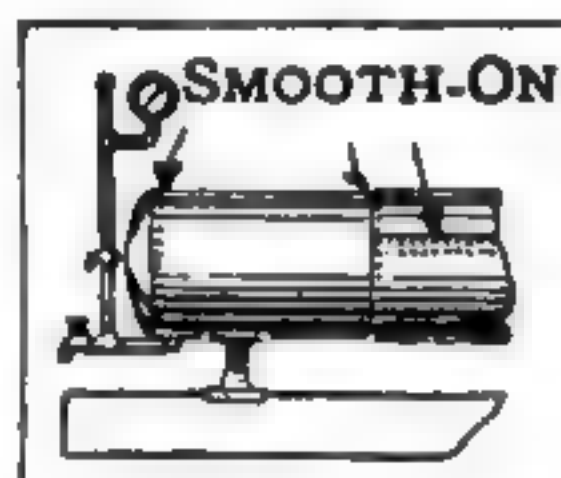
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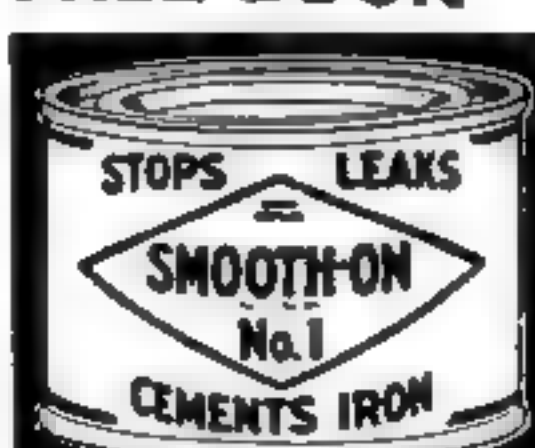
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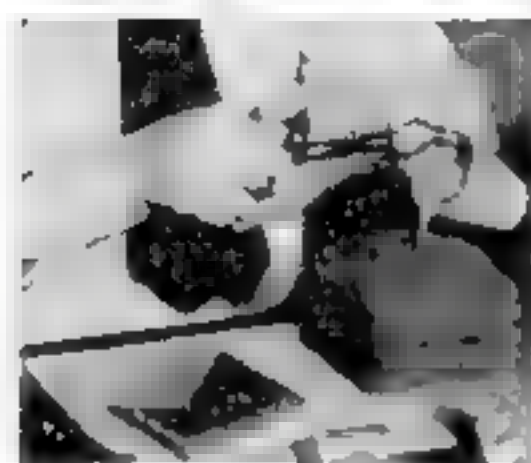
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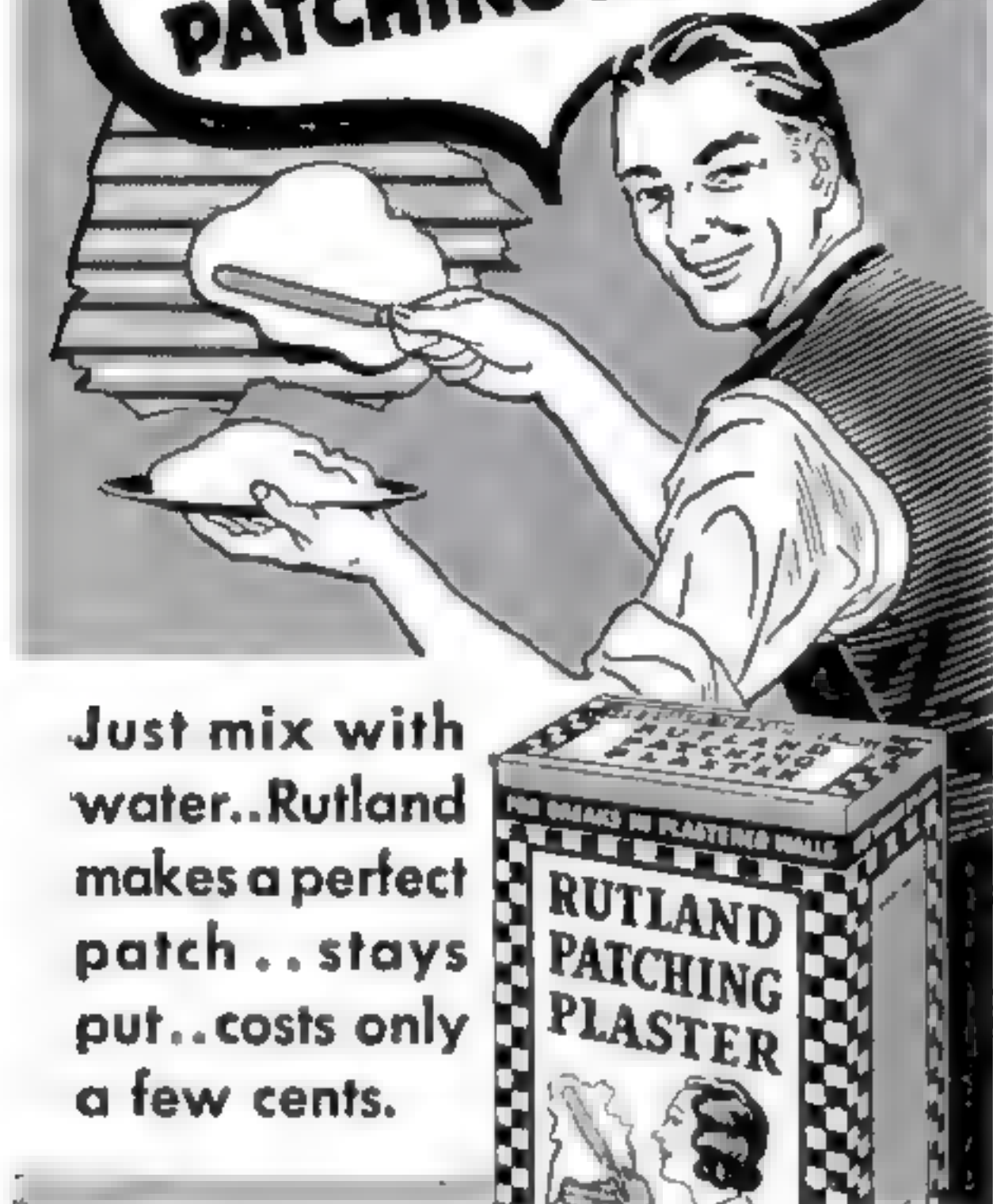


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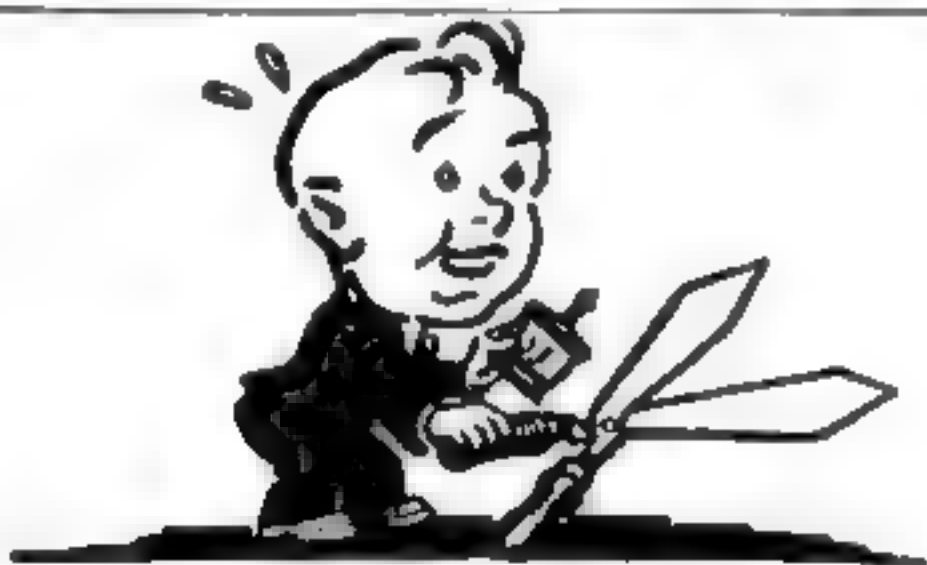
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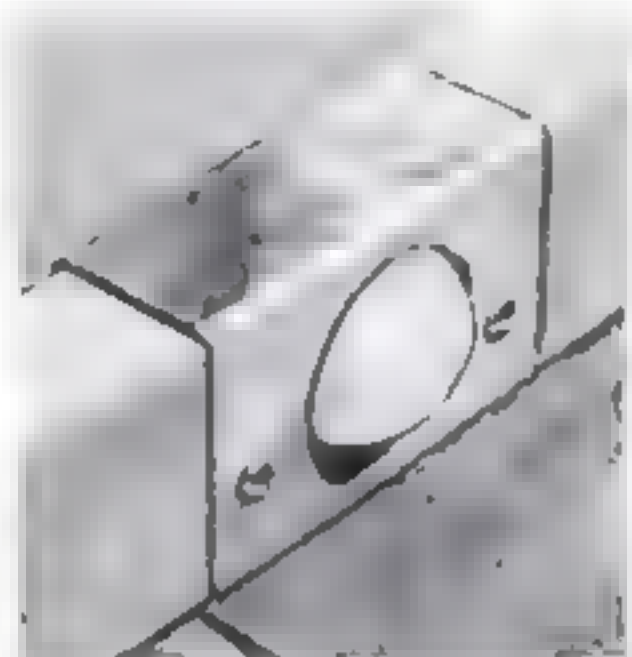
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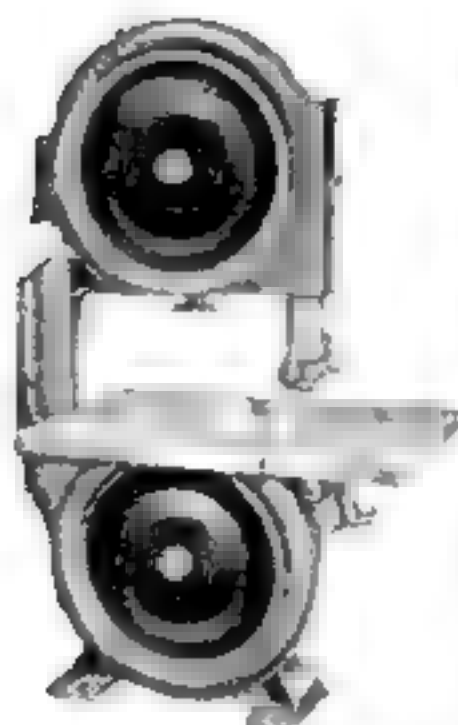
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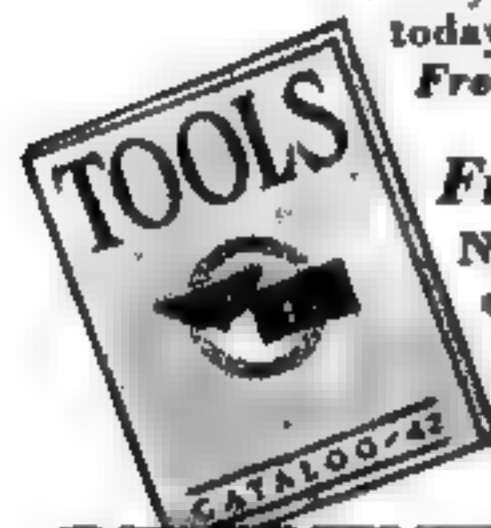
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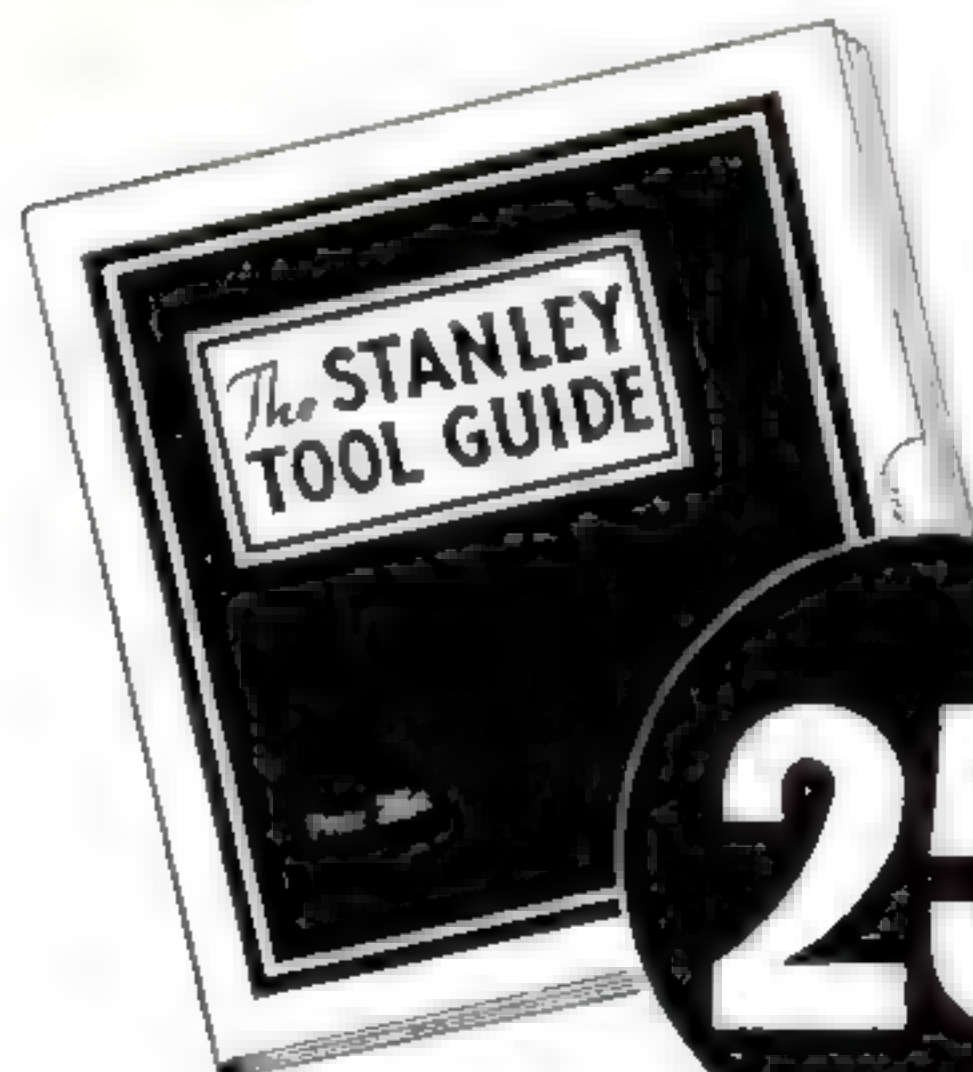
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SMALL paintbrushes can be kept in good condition by slipping an ignition wire nipple over the handle as shown. This fits snugly around the top of a bottle and holds the brush suspended in turpentine. The bristles do not rest on the bottom, and the rubber prevents the liquid from evaporating and allowing the brush to dry out.



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This One

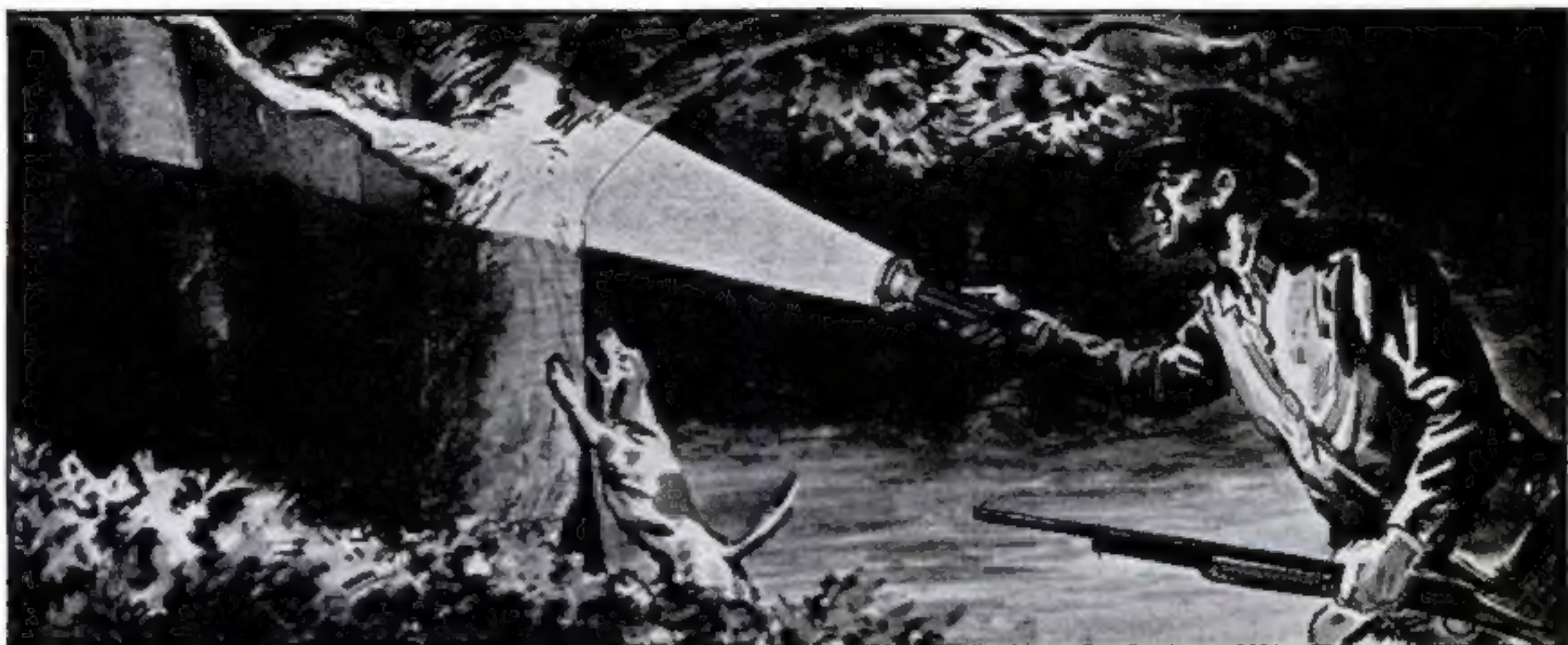


62FO-15H-HE4K

DEATH LEERS as Hunter Plummets into Pit!



JAMES KIDWELL
Mt. Vernon, Texas



① "With my hound Jep, I had bagged seven 'possums and was heading back for bed," writes James Kidwell. "I was cutting through the yard of an abandoned hilltop house, when the hound gave a frightened yelp and lit out for home."



② "I chuckled, for superstitious folks down our way regard this as an ill omen. The next moment, rotten timbers crashed under me—I was falling!"



③ "I landed at the bottom of an old well. It was impossible to scale the walls. I retrieved my flashlight from the icy water. She still worked."



④ "My only chance was to keep shooting the beam upward, hoping that it would be seen and that the batteries would last. My luck was good—two boys going home from town saw the strange flashes, and investigated. Those 'Eveready' fresh DATED batteries positively saved my life, as I would have died of exposure, if help hadn't come. You've got to be in the predicament I was before you really can appreciate the value of fresh batteries."

(Signed)

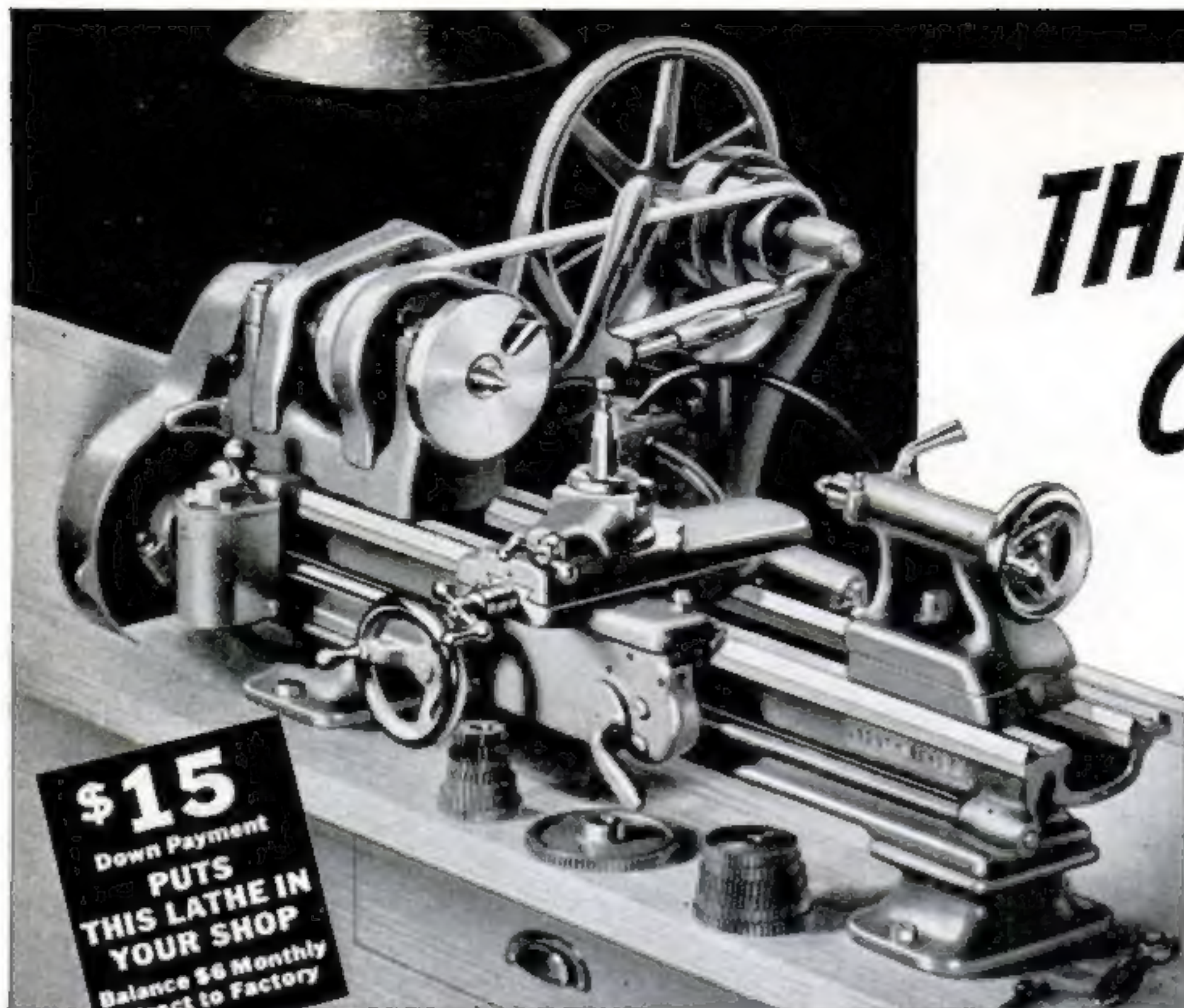
James Kidwell



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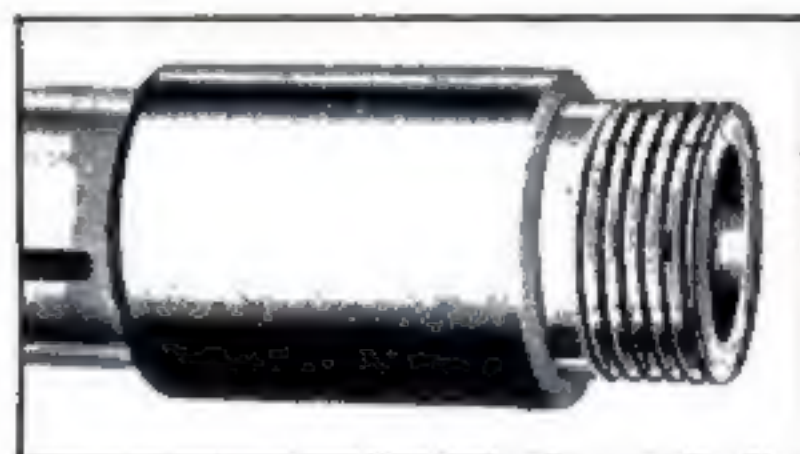
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